Century of Confusion for Cosmology After Redshift Mistake

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Introduction

Century of Confusion for Cosmology After Redshift Mistake describes the pivotal mistakes made by specific physicists since 1905, and astronomers or cosmologists since about 1912. By cosmology accepting and never fixing these mistakes, more mistakes followed, because wrong conclusions persisted rather than being removed from subsequent use. Cosmology has remained confused, as seen in the acceptance of unverifiable concepts like dark matter and dark energy, which arise and persist when the ruined foundation of physics is unable to support a valid explanation of unexpected observations. Eventually, cosmologists declared a crisis due to significant, unresolved problems. Excerpt from a 2021 news story at space.com:

Since 2014, there have been over 300 proposals for solutions to this "crisis in cosmology." None of these proposals is universally agreed upon by cosmologists, and as measurements continue, the crisis just keeps getting worse.
(Excerpt end)

This book explains those incorrect measurements.

Cosmology is clearly confused when it readily accepted the claims and elaborate descriptions provided by LIGO with no evidence for any facets of the detailed story.

In 1923, Edwin Hubble confirmed the first galaxy being outside our Milky Way by measuring the distance to a specific variable star in the disk of M31. Before that event, distant nebulae could be either inside or beyond our Milky Way.

Therefore, cosmologists have been studying distant galaxies for about 100 years (since 1923), though earlier they did not know which nebulae were galaxies.

Cosmology is a branch of physics and can be affected by changes in general physics like the application of relativity, which has its own assumptions initially defined by Minkowski who defined Minkowski space or spacetime, and then this predecessor theory was elaborated by Einstein into the theory of Relativity in 1905 (special) and 1915 (general), and much later with contributions by others like Penrose and Hawking.

1 Chronology

The following, listed by date, mark several pivotal mistakes resulting in this century of confusion for cosmology. They are listed by date, with a brief comment to show their progression.

Each item will be covered in detail in this book (though not in this exact order) to explain their significance in the evolution of the confusion, and a possible solution to each mistake.

1905, Einstein, photoelectric effect, light is quantized, not atom

1905, Einstein, Theory of Special Relativity, moving observer is special with curved path and invalid rules like a velocity limit at c for mass.

1912, Slipher, galaxy redshifts, using emission lines

1913, Slipher, M31 blue shift, using absorption lines

1915, Einstein, Theory of General Relativity, inertial observer sees no curvature

1919, Eddington, 1919 solar eclipse experiment, did not check stars away from solar limb

1920, Eddington, stellar nucleosynthesis in stars but requires impossible conditions for almost forever

1920, Time Magazine, Einstein as Person of the Century, inconclusive 1919 results

1922, Friedman, equations for the expansion of space which is assumed a perfect fluid

1924, Friedman, equations for negative spatial curvature

1926, Lewis, proposed photon for discrete units of light energy

1926, LeMaitre, Primeval Atom, he is considered father of Big Bang

1927, Lemaître, his equation became Hubble's Law

1929, Hubble, Hubble's Law, using galaxy velocity units as km/s

1933, Zwicky, coined Dark Matter for distant galaxy clusters

1935, Milne, Milne cosmological model, was relativistic but superseded

1936, Hubble, Local Group Is an Island [in] Hubble Flow, with its blue shifts

1947, Fred Hoyle in derision called the Primeval Atom explosion a Big Bang, but the name from a skeptic stuck

1948, Alpherin, CMB prediction after big bang

1957, Feynman, sticky-bead argument with relativity, gravitational waves

1962, first quasar recorded

1963, Penzias & Wilson, Cosmic Microwave Background

1966, Arp, Peculiar galaxies & quasars, red shifts are not consistent

1970, Alfven, plasma physics, still not widely taught

1974, Hawking, Hawking radiation from black hole

1978, Rubin & Kent, M31 dark matter, millions of stars in disk are not rotating like 8 planets
1998, Turner, coined dark energy
1998, Perlmutter, Supernova Cosmology Project, presumed supernovae were variable stars
2005, in Portugal, First Crisis in Cosmology Conference
2008, in Washington, Second Crisis in Cosmology Conference
2010, Team from Spain, Magnetic fields, and the outer rotation curve of M31, no dark matter
2015, Beck, Twisted magnetic field in galaxy IC342
|2015, LIGO, first gravitational wave detection, during a new moon
2015, Gardi, Planck's Constant and Nature of Light
2019, EHT, first image of a black hole, radio telescopes looking for an accretion disk but found plasmoid

This is a summary of the 22 sections:

1) Chronology lists the pivotal mistakes, by year, affecting cosmology since about 1905.

2) Matter and Plasma describes several fundamental terms and assumptions, which are background for this book.

3) Newton and Einstein section explains the transition from Newton's absolute space and time to Einstein's relative space and time:

Isaac Newton defined the foundation of physics:

a) The independence of space and time from all observers,

b) The relationship between force, mass, and acceleration,

c) The force of gravity, which is the mutual attraction between masses, diminished by inverse-square of their mutual distance.

Einstein defined a background independent context of a special moving observer and proposed their motion could be curved by changing the increments of their motion to mimic the effect of gravity. The special moving observer's reference frame enables:

a) The set of 4 parameters from this observer's motion are called-space-time, because 3 were for the change in position, or in space, and the 4^{th} was for the change in time during the change in position,

b) this curved path could end at the center of a heavy mass where the center of an object is considered a point; this end in a very massive object leads to an impossible black hole, where all the mass is claimed to be compressed into its center, or a point. This combination of mass from physics within a point from geometry while the mass maintains a gravitational field from a point having no size is impossible because this is infinite density for the mass. Black holes have their own section.

4) Electromagnetism explains the work by Maxwell and others who defined the forces from an electric field and a magnetic field. Lori Gardi explained a mistake in Planck's constant, affecting our understanding of the nature of light and our application of that important constant in physics.

5) Maxwell explained light as the propagation of these fields when perpendicular and synchronized. These fields have a rate of oscillation. The oscillation is of the two synchronized fields, not particles. A wave in a medium (like a surface wave in water) results from circular motions of the particles in the medium. There are no particles moving in circles during the oscillation of these synchronized electric and magnetic fields. In 1905, Einstein brought confusion to Maxwell's accepted explanation by proposing light comes in increments of energy. In 1926. Gilbert N. Lewis proposed the term photon for these increments of light energy. This mistake is explained in Photoelectric Effect.

Light describes the basic behaviors of light relevant to cosmology, including the different patterns of wavelength distribution in the continuum of electromagnetic radiation.

6) Photoelectric Effect

7) Doppler Effect describes one of the fundamental interpretations of a change measured in a spectrum. There are 2 possible problems: 1) One must be correct when assuming where in the light's path did the change occur. When the change is from atoms in the light of sight, not in the distant object, a mistake is made by assigning the wrong value to the distant object. And 2) the Doppler effect can only indicate motion in the line of sight, so it is impossible for the effect to indicate any transverse motion making it impossible to measure proper motion in 3-dimensions independent of an observer using this method.

8) Star Types compares the Robitaille model of a star, based on liquid metallic hydrogen, to the gaseous sun model defined by Eddington in 1922. LMH model explains all solar observations, unlike the 100-year-old gaseous sun model. A neutron star is explained in this section also.

9) Black Hole describes this impossible consequence of extreme curvature encountered by the special moving observer. A black hole is needed in cosmology to explain X-ray sources when ignoring the known mechanism of generating X-rays from a synchrotron. By ignoring the obvious choice (the first synchrotron was built in 1945), cosmologists propose an accretion disk around a black hole. This disk must develop an impossible temperature to generate a thermal emission spectrum extending to X-ray wavelengths. The thermal radiation wavelength distribution is from ultraviolet to infrared, but the accretion disk must extend beyond the accepted range

10) Galaxy Types offers basic descriptions of galaxies and their types.

11) Quasar describes this distant celestial object which is neither a star nor galaxy. These are far fewer in number than galaxies. Quasars always have a measured redshift. Quasars are part of the justification of the big bang and its expansion.

12) Dark Matter explains this theoretical undetectable source of gravity,

13) Data Sets describes the author's compilation of galaxy data. The 2 main references are Wikipedia and NASA Extragalactic Database. The data cover more than 600 galaxies, with their constellation, celestial coordinates, magnitude, red shift velocity, distance, and diameter (when available), in either light-years or minutes of arc. Over 20 Abell galaxy clusters are included for reference.

14) Hubble's Law describes the basic assumption for relating a galaxy's velocity in km/s to its distance in Mpc.

15) NED Redshifts describes the different redshift behaviors being measured for galaxies to measure its velocity. A galaxy's velocity is assumed to be related to its distance by Hubble's Law. That assumption must be questioned.

16) Cosmic Distance Ladder describes the different methods used to derive a galaxy's distance.

17) NED Distances describes the respective distance calculations, when not using the Doppler Effect as the basis.

18) Charts presents charts of which galaxies are using the different redshift and distance methods. These illustrate the justification for some conclusions.

19) Measuring Rules defines the simple, new rules for measuring the velocity and distance for both a galaxy and quasar.

20) Big Bang describes this theory which includes universe expansion. This theory is based on conclusions drawn from our measurements of the galaxies. A cosmological model arose to attempt an explanation of the universe's evolution from a primordial explosion. The big bang theory and its model rest on many assumptions which must be reviewed when this theory is almost part of the foundation of modern cosmology.

21) LIGO claims to confirm many theoretical, unproven, entities.

22) Final Conclusion summarizes the book's conclusions.

23) All external references in the book have links available as directed here.

I have written several books before this one. To use my previous research and conclusions from those books and to prevent forcing a reader to obtain the books for only further excerpts; I did the exercise of compiling excerpts from the first 7 paperback books into a pdf which can be freely distributed. The pdf is titled Return to Classical Physics; to obtain a copy, a link is found via References. My goal is distributing information and a book marks the first release of important conclusions with their supporting references, so a paperback book is a permanent archive of that release.

2 Matter and Plasma

This book is not about general chemistry or physics but these 2 topics are related, so here are the relevant details in an informal description.

Thermodynamics is important in cosmology because it describes an energy transfer or transformation. Energy must be conserved in every interaction, though it can change its form.

The various forms of energy are electromagnetic radiation (which is observed as light when the wave lengths are in a range where our eyes are sensitive), kinetic energy, thermal energy (or heat), atomic internal energy (held in electrons in an orbit carrying more energy than in the atom's ground state).
Matter has 3 general states: gas, liquid, or solid.

A gas is just loose atoms and molecules. Particles can be suspended by their kinetic energy, A gas holds apparent heat in the kinetic energy of its particles.

A liquid or gas is called condensed matter because the atoms are not loose, but are moving by their kinetic energy.

As the energetic particles collide with others, the energy is being moved by convection.

A liquid is atoms or molecules loosely bonded.

A liquid holds some of its apparent heat in the kinetic energy of its particles, but most in its molecular bond vibrations.

A solid holds its heat in its vibrations within its lattice of atoms or molecules.

As the energetic particles of a gas collide with condensed matter, the surface of a liquid or solid, its kinetic energy is absorbed and returned, like a bounce. Alternately the kinetic energy is transformed into thermal energy in the surface of the liquid or solid.

Condensed matter can convert some of its thermal energy into radiated energy.

This behavior is called emissivity.

Excerpt from Wikipedia:

The emissivity of the surface of a material is its effectiveness in emitting energy as thermal radiation. Thermal radiation is electromagnetic radiation that may include both visible radiation (light) and infrared radiation, which is not visible to human eyes. The thermal radiation from very hot objects is easily visible to the eye. Quantitatively, emissivity is the ratio of the thermal radiation from a surface to the radiation from an ideal black surface at the same temperature as given by the Stefan–Boltzmann law.

(Excerpt end)

Observation:

Thermal radiation is explained further in the section Light. That description includes a figure with the solar spectrum.

3 Newton and Einstein

This section describes the transition from:

a) Newton’s defining the foundation of physics and the real force of gravity, to

b) Space-time, which is the foundation of Einstein’s relativity, becoming a proclaimed replacement of the foundation set by Newton. Space-time is a newly defined context of a special, moving observer, where special, new rules can be applied, like the velocity of a mass being limited to the velocity of light. This unjustified limit is now a known mistake, after protons moving at multiples of c have been measured in several quasars.

Relativity enabled the definition of a black hole. A black hole was described by both Einstein and Hawking, and is claimed by many as being observed in 2019.

3.1 Introduction to Newtonian physics

By defining the initial foundation of physics, Isaac Newton defined what could be called classical physics, because the subsequent foundation could be called modern physics.

Excerpts from Wikipedia:

"According to Newton, absolute time exists independently of any perceiver and progresses at a consistent pace throughout the universe.

Absolute space, in its own nature, without regard to anything external, remains always similar and immovable. Relative space is some movable dimension or measure of the absolute spaces; which our senses determine by its position to bodies: and which is vulgarly taken for immovable space ... Absolute motion is the translation of a body from one absolute place into another: and relative motion, the translation from one relative place into another ...

— Isaac Newton

(Excerpt end)

In my words, absolute space is the background, has no features, and remains always immovable.

In my words, the universe has no observed or defined limits and it has much stuff in this space.

After Newton, physicists understood absolute time and absolute space. They exist independently of any observer.

Most are aware of Euclidean geometry with its definitions of a plane, line, parallel, and point. Most are also aware of the Cartesian coordinate system, where the point of origin defines the direction of increasing values in each axis (x,y,z).

In physics, a reference point in absolute space is identified for the origin of the coordinate system, so the measurements using the defined axis dimensions are relative to the reference point, not to the observer. Another observer can use the same reference point to share measurements, when using the same dimensions.

An observer is not limited to Cartesian coordinates.

The center of the Earth serves as the reference point for multiple coordinate systems. Among them is the geographic coordinate system, whose 2 angular dimensions are latitude and longitude. The Global Positioning system (GPS), using an array of satellites, adds a linear dimension for the observer’s altitude.

Another is the celestial coordinate system, whose 2 angular dimensions are right ascension and declination. When using this system, the observer accounts for their position on the Earth’s surface relative to the center so celestial measurements from different surface locations match.

These coordinate systems when using a common reference point enable measurements independent of the observer.

When using a common coordinate system and reference point, we can measure the location of any object or event and the time of each measurement to calculate its velocity and acceleration. Sometimes, many position measurements from different locations enable a distance calculation by parallax. This technique for a distance is used in our solar system and in our Milky Way.

3.2 Newton’s laws of motion

Excerpt from Wikipedia:

In classical mechanics, Newton's laws of motion are three laws that describe the relationship between the motion of an object and the forces acting on it. The first law states that an object either remains at rest or continues to move at a constant velocity, unless it is acted upon by an external force. The second law states that the rate of change of momentum of an object is directly proportional to the force applied, or, for an object with constant mass, that the net force on an object is equal to the mass of that object multiplied by the acceleration. The third law states that when one object exerts a force on a second object, that second object exerts a force that is equal in magnitude and opposite in direction on the first object.

(Excerpt end)

Observation:

The second law is the equation: $F = ma$
Where F is the force, m is the mass, and a is the acceleration.
One should note the equation for the force has no time variable. The force is instantaneous. A sustained force spanning a known time results in a predictable velocity.

3.3 Newton's law of universal gravitation

Excerpt from Wikipedia.

In today's language, the law states that every point mass attracts every other point mass by a force acting along the line intersecting the two points. The force is proportional to the product of the two masses, and inversely proportional to the square of the distance between them.
The equation for universal gravitation thus takes the form:

F = (m1*m2)/r2

where F is the gravitational force acting between two objects, m1 and m2 are the masses of the objects, r is the distance between the centers of their masses, and G is the gravitational constant.
The first test of Newton's theory of gravitation between masses in the laboratory was the Cavendish experiment conducted by the British scientist Henry Cavendish in 1798. It took place 111 years after the publication of Newton's Principia and approximately 71 years after his death.

Newton's law of gravitation resembles Coulomb's law of electrical forces, which is used to calculate the magnitude of the electrical force arising between two charged bodies. Both are inverse-square laws, where force is inversely proportional to the square of the distance between the bodies. Coulomb's law has the product of two charges in place of the product of the masses, and the Coulomb constant in place of the gravitational constant.

(Excerpt end)

Observation:

One should note the equation for the force has no time variable. The force is instantaneous. There are two participants, so the force is mutual and simultaneous.

3.4 Introduction to Relativity

Some advocates of relativity believe in the adage: “Spacetime tells matter how to move; matter tells spacetime how to curve.”

For someone to believe that adage, they do not understand a) coordinate systems and b) the basis of space-time, and c) physics, the science describing motion.

Space-time is just a set of 4 values from the special observer’s incremental motion. This set is used by only the tensor equations in the theory. This set is used to curve the path of the moving observer. This set has no application beyond the limited context of the special observer.
This set is not a thing which can interact with matter.

Only a force can cause motion. This is rudimentary physics.

Isaac Newton defined his laws of motion and several equations, including one for the force of gravity between 2 masses.

James Clerk Maxwell and others defined equations for electromagnetism. Maxwell is credited with bringing together several developments, including an equation for the electric force between 2 charges. Other equations are for a magnetic field, which acts on moving charges.

No matter how someone distorts a coordinate system, it is not a force and cannot affect motion.

3.5 Story of Space-time and gravity

When physicists adopted Einstein's narrowly defined behaviors of a special observer as important to the science of physics, then they broke the foundation of Newtonian physics.

Before space-time, physicists understood gravity. Newton defined it as a mutual force between 2 masses. The force required no time for its action, so it was instantaneous and simultaneous. This understanding of the force of gravity enabled the discovery of the planet Neptune in 1846, using only Newton's equations, following many measurements of planet positions over time.

Einstein derailed this understanding by developing the limited context of his special, moving observer.

Excerpt from Wikipedia, where its Minkowski Space topic explains the transition:

The views of space and time which I wish to lay before you have sprung from the soil of experimental physics, and therein lies their strength. They are radical. Henceforth space by itself, and time by itself, are doomed to fade away into mere shadows, and only a kind of union of the two will preserve an independent reality.

— Hermann Minkowski, 1908, 1909

Though Minkowski took an important step for physics, Albert Einstein saw its limitation:

At a time when Minkowski was giving the geometrical interpretation of special relativity by extending the Euclidean three-space to a quasi-Euclidean four-space that included time, Einstein was already aware that this is not valid, because it excludes the phenomenon of gravitation.

(Excerpt end)

Observation:

Einstein integrated gravitation into the quasi-Euclidean four-space.
Another excerpt from Wikipedia, where its topic of History of special relativity describes the transition:

Some scientists and philosophers of science were critical of Newton's definitions of absolute space and time. Ernst Mach (1883) argued that absolute time and space are essentially metaphysical concepts and thus scientifically meaningless, and suggested that only relative motion between material bodies is a useful concept in physics.

Mach argued that even effects that according to Newton depend on accelerated motion with respect to absolute space, such as rotation, could be described purely with reference to material bodies, and that the inertial effects cited by Newton in support of absolute space might instead be related purely to acceleration with respect to the fixed stars.

In 1907 Minkowski named four predecessors who contributed to the formulation of the relativity principle: Lorentz, Einstein, Poincaré and Planck. And in his famous lecture Space and Time (1908) he mentioned Voigt, Lorentz and Einstein. Minkowski himself considered Einstein's theory as a generalization of Lorentz's and credited Einstein for completely stating the relativity of time.

Einstein (1908) tried – as a preliminary in the framework of special relativity – also to include accelerated frames within the relativity principle. In the course of this attempt he recognized that for any single moment of acceleration of a body one can define an inertial reference frame in which the accelerated body is temporarily at rest. It follows that in accelerated frames defined in this way, the application of the constancy of the speed of light to define simultaneity is restricted to small localities. However, the equivalence principle that was used by Einstein in the course of that investigation, which expresses the equality of inertial and gravitational mass and the equivalence of accelerated frames and homogeneous gravitational fields, transcended the limits of special relativity and resulted in the formulation of general relativity.

Eventually, Einstein (1912) recognized the importance of Minkowski's geometric spacetime model and used it as the basis for his work on the foundations of general relativity.

Acceptance of special relativity

Planck, in 1909, compared the implications of the modern relativity principle — he particularly referred to the relativity of time – with the revolution by the Copernican system. An important factor in the adoption of special relativity by physicists was its development by Minkowski into a spacetime theory. Consequently, by about 1911, most theoretical physicists accepted special relativity.

(Excerpt end)

My observations:

First:

Physicists at the time were determined to get relative time, to replace Newton's absolute time, which cannot be affected by the observer.
The phrase "simultaneity is restricted to small localities" reveals another concern with time.

Both the electric force and the gravity force are simultaneous between the 2 participants but each force decreases by the inverse square of the distance between them. In reality, the 2 forces cannot be restricted to a "small locality."

Second:

One must note Einstein's work with the "equivalence of accelerated frames and homogeneous gravitational fields" brought with it "a new treatment of gravity, replacing the understanding of the force at that time (1912)."

This "new treatment" is simply wrong. The replacement of our "understanding of the force" was a mistake.

The unstated goal of some physicists "at that time (1912)" was replacing Newtonian physics with the possible flexibility of relative space and time.

There was no evidence space-time was better than Newton's force. The dubious evidence was provided from Eddington, by photographs taken during a total solar eclipse in 1919. That was sufficient for the 4-dimensions of space-time becoming a fundamental concept of physics.

The perceived "homogenous field" can arise only in the combination of a number of tiny masses near a much larger mass, like the drop of a feather and iron ball in a vacuum. This free-fall acceleration behavior was famously demonstrated on Earth and on the Moon.

Free-fall acceleration is a very limited context of gravity. The much larger mass has only the illusion of no motion. Perhaps Einstein accepted the illusion because space-time curvature cannot affect the other mass. For example, all the planets in the solar system are not in free fall acceleration in the gravitational fields of all other planets. It is a mistake basing a replacement of the real force of gravity on this context of a particular behavior.

An observer having any mass, must interact with any other mass by inverse square of distance, as explained by Newton, and as widely accepted, before space-time, like when predicting Neptune.

Space-time enables the moving observer to never affect another mass. This is simply violating Newton's force and replacing it with an incorrect interpretation.

I will take liberties here when putting relativity into simpler terms.

The special observer is moving, so in relativity their motion is described by the combination of 4 variables at each instant, in this "quasi-Euclidean four-space"

The 4 are: dx, dy, dz, dct, where "d" represents the "delta" or change in coordinate in that Euclidean dimension.

The math requires the same units among all the participants; km is the standard for a linear dimension value. Since the units for time are unlike the spatial dimensions, the time value is multiplied by the constant c, to get km as units. This product is shown as ct, and its value in the set of 4 is dct.

This observer can measure the direction to another mass to get a vector to the source of that object's gravitational field.

Relativity is background independent, so no coordinates in real, physical, or absolute space are available, for the observer or for any object they observe.

Every distance or location measurement is relative to the moving observer's current position.

Space-time is simply the mechanism for the application of the tensor equations affecting the path of the special, moving observer by using this set of changes in 4 coordinates per unit of time.

Space-time has no application other than supporting the equations of relativity.

This is the only context where this "union of the two [space and time] will preserve an independent reality."

My observation:

This phrase has an add choice of words. Newton defined absolute space and time as independent of the observer. Space-time defined the special moving observer as having no effect on any other mass or charge, during the motion. Since space-time does not identify an effect between the observer's and another's charge, space-time implicitly ignores any mutual interaction between the observer and the rest of the universe which will have mass and could have a charge.
Of course, other masses must react to the moving observer’s mass, but relativity identifies none.
An ocean tide changing with phases of the Moon is strictly a behavior from the force of gravity. That narrow behavior by a force cannot be explained by space-time which tries to mimic another narrow behavior of gravity, free-fall acceleration. A tide cannot be characterized as a free-fall acceleration.

This independent reality" is useless, beyond a game of an odd alternate reality, where literally nothing happens to whatever you pass during your motion.

This certainly a wrong form of independence for physics, where any motion is always driven by external forces. The forces from mass or charge are always mutual, though reduced by inverse-square of distance. Thus, any celestial body in motion must affect others, though it could be too weak to measure.

Space-time is wrong; Newton's force of gravity is correct. Kepler's laws of planetary motion were developed on the basis of Newton's mutual force between masses. The orbital path of an ellipse is around a system's center of gravity.

Observation about absolute and relative time:

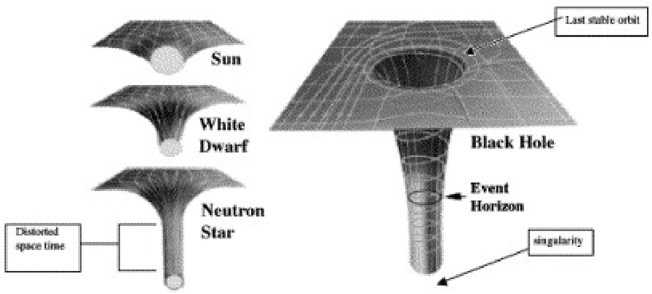
If an observer ever questions their relative time, like for possible time dilation, they can always "look out the window" to check the correct absolute time.

This "window" reference is from Einstein's famous thought experiment on a hypothetical train, using a hypothetical light clock. I heard this phrase from someone else, long ago, but it still resonates with me. Our version of Newton's absolute time is driven by an atomic clock and cannot be affected by anyone, certainly not by someone in a train using a light clock.
The special observer's space-time prevents "looking out the window" when restricted to a time value which can be manipulated during the special observer's motion. Newton could not envision someone altering the normal progression of time's increments, so it was simply called absolute time.

3.6 Space-time in Graphics

Graphical representations of space-time curvature are an intentional deception.

This unedited image from NASA will help explain this deception.



In relativity, when the observer is moving near an object with a gravitational field their current motion is obtained in 4 parameters having the observer’s change in 3-D space, and the change in time during each incremental motion. These values are manipulated to curve the path toward the source of the gravitational field.
This curvature affects only the path of the moving observer, so no one else is affected.

The left column in the image illustrates how the special observer's path in space-time could be curved when they are passing by the Sun, a white dwarf, or a neutron star.

For all other observers, the Sun, the white dwarf, or the neutron star, are observed using classical physics, such as electromagnetic radiation.

The image is deceptive because there is no distinction between a) the observer who is moving to or past these objects and b) all other observers.

One could present an edited image to represent the view for all other observers by simply removing those curved graphics which show the special observer's distorted path in space-time. At the lower left is the legend "distorted space time." This explicitly notes the specific context for this image. That edited image removes the deception by showing the real universe, in which all observers can observe and measure, and which is not affected by the special observer's motion past a particular body in physical space.

The right column in the image has the most blatant deception.

The single arrow pointing to "Singularity" (at bottom right) is actually pointing to 2 entities.

1) The physical mass at that location in physical space,

The mass is not shown in this column, though each mass was shown in the left column.

The image could be edited as suggested to remove the graphs from the respective columns; then the mass should be shown here, consistent with the others, to help fix the deception for all observers other than the one moving (i.,e., non-inertial).

2) A point in the observer's reference frame or coordinate system.

The point is not in the image simply because a point has no size.

In basic terms of geometry, the center of an object, regardless of its shape, is described as a point.
In the mathematical exercise of space-time curvature for an extreme mass, the path of the observer must terminate at the center of the mass, or a point. This point in geometry is called the singularity in physics.

This singularity is called a black hole though technically it is a black point. There is no hole in anything; it is just a point in a coordinate system.

The deceptive graphic hides this mistake in physics with two simultaneous conflicting entities where one entity is a concept, just a point in a coordinate system, while the other is a physical mass.

For all other observers, the mass remains and can be observed and measured and, as a mass, it is still subject to the force of gravity from other bodies. It is a violation of physics to claim this mass simply disappears.

It is also a violation of physics to claim the mass remains intact, still generating its gravitational field, while compressed within a geometric point, or the claimed singularity.

Physicists chose to combine these two conflicting entities from geometry and physics, resulting in something physically impossible.

There should be another arrow in the image next to that of Singularity and pointing to the same point but with the legend "Impossible"

There is no such thing as a black hole. This will be explained further in its section.

Probably, if graphical representations of space-time curvature were not deceptive then impossible entities like black holes would go away.

Also, the mistaken claim of remote gravitational lensing should also go away having no justification for a remote curvature.

To present the correct consequences of a proposed black hole, the image for all observers, except for the special observer, who have no distorted space-time, the bottom right should have this note inserted using the Sun's graphic icon (instead of O):

(Begin note)

Milky Way SMBH has O x 4.1 million visible to all other observers.

(End of note)

That simple change to the figure clearly unveils the deception because there is NO real mass of that size, being observed at that location claimed for that super massive black hole.

Space-time is not an acceptable replacement for Newton’s force of gravity.

4 Electromagnetism

Electromagnetism is the interaction between electric and magnetic fields and the forces which can result from those fields.

Excerpt from Wikipedia:

Electromagnetism is a branch of physics involving the study of the electromagnetic force, a type of physical interaction that occurs between electrically charged particles. The electromagnetic force is carried by electromagnetic fields composed of electric fields and magnetic fields, and it is responsible for electromagnetic radiation such as light. It is one of the four fundamental interactions (commonly called forces) in nature, together with the strong interaction, the weak interaction, and gravitation.
With the publication of "A Dynamical Theory of the Electromagnetic Field" in 1865, [James Clerk] Maxwell demonstrated that electric and magnetic fields travel through space as waves moving at the speed of light.

(Excerpt end)

In 1970, Hannes Alfven was awarded the Nobel Prize in Physics for defining Plasma Physics as a new branch of physics to emphasize the plasma and electromagnetic behaviors which general physics was ignoring. 50 years later, Alfven’s work is still not integrated, so nonsense like dark matter is proposed because a magnetic field is ignored.

Maxwell's equations define several properties of "free space" and those values define the rate of propagation of light through that free space.

Now, they can be considered properties of either: the vacuum of space, or the aether, which is whatever unknown "stuff" permeates the background of the universe.

The medium defines the rate of propagation of the synchronized electric and magnetic fields within light.

Most know light travels slower through glass or water than through air or space.

The diffraction index is the factor defining the change in light velocity by the medium.

Essentially, the medium has a measurable resistance to the changing of electric and magnetic fields. During the propagation of light, both fields are oscillating or in continuous change.
Light is more complicated then that simple statement because different wave lengths have different behaviors like X-rays which can be either penetrating or shielded by different media.
For example, the color violet is slower than red through a glass prism.

At the foundation of Maxwell's equations are 2 constants which define how the medium affects changes in an electric field or a magnetic field:

the permittivity of free space, $\varepsilon 0$, epsilon-nought
the permeability of free space, μ, mu

These factors become Coulomb's constant.

The Electric force is described by Coulomb's law.

$F = ke * (q1 * q2) / r^2$

where ke is Coulomb's constant ($ke \approx 8.99\times10^9$ N·m^2·C^{-2}), q1 and q2 are the signed magnitudes of the charges, and the scalar r is the distance between the charges. The force of the interaction between the charges is attractive if the charges have opposite signs (i.e., F is negative) and repulsive if like-signed (i.e., F is positive).

In very simple terms, there is a mutual force between any 2 charges. This electric force is reduced by 2 factors:

1) ke from the medium,

2) r from the distance.

Observation:
The units of ke are essentially a ratio of force in an area relative to charge.

Free space defines a factor within ke resulting in a force reduction between charges.

One should note the equation for the force has no time variable. The force is instantaneous. There are two participants, so the force is mutual and simultaneous.

Excerpt of Magnetic field from Wikipedia:

A magnetic field is a vector field that describes the magnetic influence on moving electric charges, electric currents, and magnetic materials. A moving charge in a magnetic field experiences a force perpendicular to its own velocity and to the magnetic field. A permanent magnet’s magnetic field pulls on ferromagnetic materials such as iron, and attracts or repels other magnets. In addition, a magnetic field that varies with location will exert a force on a range of non-magnetic materials by affecting the motion of their outer atomic electrons.

Magnetic fields surround magnetized materials, and are created by electric currents such as those used in electromagnets, and by electric fields varying in time. Since both strength and direction of a magnetic field may vary with location, they are described as a map assigning a vector to each point of space or, more precisely—because of the way the magnetic field transforms under mirror reflection—as a field of pseudovectors.

In electromagnetics, the term "magnetic field" is used for two distinct but closely related vector fields denoted by the symbols **B** and **H**. In the International System of Units, **H**, magnetic field strength, is measured in the SI base units of ampere per meter (A/m). **B**, magnetic flux density, is measured in tesla (in SI base units: kg per second^2 per ampere), which is equivalent to newton per meter per ampere. **H** and **B** differ in how they account for magnetization. In a vacuum, the two fields are related through the vacuum permeability, μ_0 = **H**; but in a magnetized material, the terms differ by the material's magnetization at each point. Magnetic fields are produced by moving electric charges and the intrinsic magnetic moments of elementary particles associated with a fundamental quantum property, their spin. Magnetic fields and electric fields are interrelated and are both components of the electromagnetic force, one of the four fundamental forces of nature.

(Excerpt end)

Excerpt of Lorentz Force from Wikipedia:

In physics (specifically in electromagnetism) the Lorentz force (or electromagnetic force) is the combination of electric and magnetic force on a point charge due to electromagnetic fields. A particle of charge q moving with a velocity **v** in an electric field **E** and a magnetic field **B** experiences a force of

$$\mathbf{F} = q\mathbf{E} + q\mathbf{v} \times \mathbf{B}$$

(in SI units). It says that the electromagnetic force on a charge q is a combination of a force in the direction of the electric field **E** proportional to the magnitude of the field and the quantity of charge, and a force at right angles to the magnetic field **B** and the velocity **v** of the charge, proportional to the magnitude of the field, the charge, and the velocity. Variations on this basic formula describe the magnetic force on a current-carrying wire (sometimes called Laplace force), the electromotive force in a wire loop moving through a magnetic field (an aspect of Faraday's law of induction), and the force on a moving charged particle.

Historians suggest that the law is implicit in a paper by James Clerk Maxwell, published in 1865. Hendrik Lorentz arrived at a complete derivation in 1895, identifying the contribution of the electric force a few years after Oliver Heaviside correctly identified the contribution of the magnetic force.

(Excerpt end)

Observation:

One should note the equation for the force has no time variable. The force is instantaneous.

The Standard Model has a set of 4 fundamental forces.

Excerpt from Wikipedia on electromagnetism:

The electromagnetic force is one of the four known fundamental forces. The other fundamental forces are:

- the strong nuclear force, which binds quarks to form nucleons, and binds nucleons to form nuclei.
- the weak nuclear force, which binds to all known particles in the Standard Model, and causes certain forms of radioactive decay. (In particle physics though, the electroweak interaction is the unified description of two of the four known fundamental interactions of nature: electromagnetism and the weak interaction);
- the gravitational force.

(Excerpt end)

Observation:

My updated atomic model has new definitions of the strong and weak forces.

4.1 Planck's Equation

Lori Gardi recently concluded Planck's equation has a mistake in its units where h x f cannot = energy.

She had other conclusions as well; some are relevant to quantum mechanics.

The YouTube video by Lori Gardi is titled:

Planck's Constant and the Nature of Light

An academic paper is also linked in the references.
They are recommended for 5 reasons:

1) The well accepted Planck's equation has a bug. She has a thorough explanation which is worthwhile to hear.

A simple revelation worth noting here is:

Planck's equation has a mistake in its units. As a result:

E = hf should be either:
a) $\Delta E = hf$
b) E = htf

where t is the time for the measurement.

She remarks this mistake and its fix have consequences for quantum mechanics.

2) The energy in light is in the intensity of a particular wavelength, not only in the frequency, as is currently implied by the mistaken formula.

3) This video has another useful explanation of why there is no photon.

Light is a wave, not a particle. The electric and magnetic fields are oscillating with a consistent wavelength during its propagation after initiation. Light never has a particle behavior.

Particles require a mass to be detectable and measurable.

The conclusion that wavelength intensity carries the energy is relevant to some absorption events.

4) Planck's constant defines the minimum wavelength of light.

In some cases, the usage of Planck's constant must change because its units failed to address the missing time variable in Planck's original equation. One usage is the uncertainty principle.

5) The uncertainty principle in quantum mechanics can have the uncertain limits defined so now they are not truly uncertain.

Copying much of her content here is not appropriate.

I have nothing to contribute to her excellent work. Excerpts can remove important context.

Observation:

From the video, this equation should be true:

$\Delta E = hc/\lambda$

Because a wavelength is often used in this book, this particular formula is important.
The term “quantum of energy” for one photon refers to this equation. There is no photon, but a wavelength can carry energy as calculated here.

5 Light

Electromagnetic radiation is the propagation of synchronized, perpendicular electric and magnetic fields. The propagation has a defined rate of oscillation measured as either a frequency or a wavelength.

The wavelength is usually measured in either nanometers (10^{-9} m) or Angstroms (10^{-10} m or 0.1 nm).

The velocity of this propagation has been measured in a vacuum using our standard definition for time and this measured value is called the constant c. This measurement also defined the standard unit of 1 meter. The velocity of propagation is reduced in a medium, defined by the medium's diffraction index.

Light transmits energy proportional to its frequency, so the constant c appears in some physics equations involving energy. There is no photon.

Quantum physics defined a theoretical particle called a photon to refer to a single wavelength.
In this section, wavelength is used because a spectrum analysis uses specific numerical values. Using photon instead of wavelength only introduces possible confusion.

5.1 Light and wavelengths

A spectrum is the entire range of wavelengths in electromagnetic radiation where light is the visible range. The ultraviolet and infrared ranges are not visible to the human eye, but they are in the Sun's radiation. Because this topic is about the visible stars and galaxies, the word light is often used for the entire spectrum, including those frequency ranges not visible.

5.2 Fraunhofer Lines

This description provides background for many terms and their use in a spectrum analysis.

Excerpt from Wikipedia:

In 1814, Fraunhofer independently rediscovered the [dark] lines and began to systematically study and measure the wavelengths where these features are observed. He mapped over 570 lines.

About 45 years later Kirchhoff and Bunsen noticed that several Fraunhofer lines coincide with characteristic emission lines identified in the spectra of heated elements. It was correctly deduced that dark lines in the solar spectrum are caused by absorption by chemical elements in the solar atmosphere. Some of the observed features were identified as telluric lines originating from absorption by oxygen molecules in the Earth's atmosphere.

Because of their well–defined wavelengths, Fraunhofer lines are often used to characterize the refractive index and dispersion properties of optical materials.

(Excerpt end)

5.3 Atom's characteristic wavelengths

Calcium and hydrogen are the most frequently observed atoms in the spectrum of a distant galaxy or quasar.

The calcium atom is important because a galaxy can have its ion's pair of calcium absorption lines at 3934 and 3969 Angstroms in its spectrum when a calcium ion is in the line of sight to the galaxy. A red or blue shift of this pair of lines indicates the relative velocity of the ion. The neutral calcium atom has a different pair of wavelengths.
Nearly all matter in the universe is plasma, or it has an electrical charge. That includes electrons (-), protons(+), and ions (+) which are atoms having lost one or more electrons.

Hydrogen is the most common element in the universe; it is also the simplest having only one proton and one electron.

Excerpt from Wikipedia:

In physics, the Lyman-alpha line is a spectral line of hydrogen, or more generally of one-electron ions, in the Lyman series, emitted when the electron falls from the n = 2 orbital to the n = 1 orbital, where n is the principal quantum number. In hydrogen, its wavelength of 1213.67 angstroms corresponding to frequency of 10^{15} hertz, places the Lyman-alpha line in the ultraviolet part of the electromagnetic spectrum, which is absorbed by air. Lyman-alpha astronomy must therefore ordinarily be carried out by satellite-borne instruments, except for extremely distant sources whose red shifts allow the hydrogen line to penetrate the atmosphere.

(Excerpt end)

Observation:

This wavelength is important because a quasar usually has this emission line in its spectrum. A shift of this emission line wavelength indicates the relative velocity of the atom.

5.5 Synchrotron Radiation

Excerpt from Wikipedia:

Synchrotron radiation, electromagnetic energy emitted by charged particles (e.g., electrons and ions) that are moving at speeds close to that of light when their paths are altered, as by a magnetic field. It is so called because particles moving at such speeds in a variety of particle accelerator that is known as a synchrotron produce electromagnetic radiation of this sort.

Many kinds of astronomical objects have been found to emit synchrotron radiation as well. High-energy electrons spiraling through the lines of force of the magnetic field around the planet Jupiter, for example, give off synchrotron radiation at radio wavelengths. Synchrotron radiation at such wavelengths and at those of visible and ultraviolet light is generated by electrons moving in the magnetic field associated with the supernova remnant known as the Crab Nebula. Radio emissions of the synchrotron variety also have been detected from other supernova remnants in the Milky Way Galaxy and from extragalactic objects called quasars.

(Excerpt end)

Observation:

There are many X-ray point sources in the universe including one at the core of most spiral galaxies.

As somewhat described in the excerpt above, all those X-ray sources have an electrical current whose path is bent by a magnetic field resulting in this broad spectrum of wave lengths spanning from X-ray to infrared.

Quasars are typically dimmed in the optical wave lengths by their surrounding clouds of gas and dust.

5.6 Thermal Radiation

Excerpt from Wikipedia:

Thermal radiation is electromagnetic radiation generated by the thermal motion of particles in matter. All matter with a temperature greater than absolute zero emits thermal radiation.

If a radiation object meets the physical characteristics of a black body in thermodynamic equilibrium, the radiation is called blackbody radiation. Planck's law describes the spectrum of blackbody radiation, which depends solely on the object's temperature. Wien's displacement law determines the most likely frequency of the emitted radiation, and the Stefan–Boltzmann law gives the radiant intensity for the wave length.

(Excerpt end)

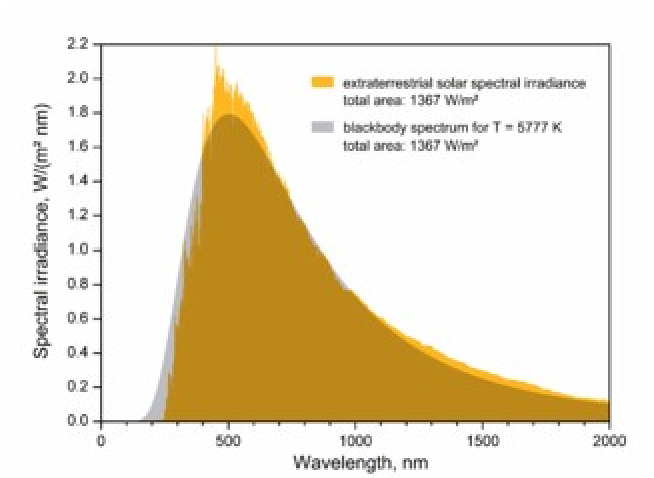
Thermal radiation is also one of the fundamental mechanisms of heat transfer. Conduction between adjacent solid objects is another.

Its spectrum is characterized by a wavelength distribution, with the wavelength having the highest intensity related to the object’s temperature.

The wavelength distribution affects whether it is visible. A cool temperature won't be. When warmer the increasing infrared intensity can be felt as heat or warmth but not seen. A rising temperature will become visible as red. When even hotter the mix of color wave lengths can result in "white hot." Our Sun is hot enough to generate the ultraviolet frequency which is not visible but can affect the eyes and skin.

Our white Sun can appear yellow when overhead due to the wavelength distribution after the light passes through our atmosphere. The atmosphere can also cause a color change between sun rise and sun set, and it causes the sky to be blue.

Here is the thermal radiation spectrum from our Sun (from Wikipedia)



Important note about wave lengths:

Thermal radiation typically spans from ultraviolet to infrared to wave lengths covering most temperatures.

Infrared is always present but shorter wave lengths arise with a high enough surface temperature. Our Sun's thermal radiation, seen as light, is in this wave length range of UV to infrared.

Most emission lines from atoms range from visible to ultraviolet wave lengths. As a general rule, any wave lengths measured outside of this range, like radio at the low end, and X-ray or gamma ray at the high end, were emitted by a source of synchrotron radiation.

A fictitious black hole violates this general rule because the impossible hot accretion disk is claimed to emit X-rays but that energy requires an impossible temperature.

Thermal radiation requires a surface.

The temperature of a gas is measured by the kinetic energy of its atoms or molecules. A gas cannot emit thermal radiation. When its atoms and molecules become ionized, then as each ion captures an electron, they emit their characteristic wave length of electromagnetic radiation. This is the non-thermal mechanism for the color of a neon light.

5.7 Spectrum wave lengths and ranges

For a convenient reference, here are various wave lengths and their ranges.

gamma rays 1pm or E-12 m
hard x-rays 10pm or E-11 m
soft x-rays 100 pm or E-10 m or Angstroms
extreme UV 10 nm or E-9 m
near UV 100 nm or E-7 m
UVC 100-280 nm
UVB 280-315 nm
UVA 315-400 nm

visible colors are between 380-750 nm
The visible colors in Angstroms:

Violet 4000
Blue 4600
Cyan 4900
Green 5000
Yellow 5800
Orange 6000
Red 7000

near infrared 1 um or E-6 m
mid infrared 10 um or E-5 m
far infrared 100 um or E-4 m
EHF 1 mm or E-3 m
SHF 10 mm or E-2 m
UHF 100 mm or E-1 m
VHF 1 m
HF 10 m

5.8 Hierarchy of Reactions to light

An atom in the path of electromagnetic radiation must do one of the following:

1) Particle pair production,
2) Ionization,
3) Compton scattering,
4) Photoelectric effect,
5) Absorption line,
6) Reflect or re-emit it,
7) Transfer to vibration in a molecular bond,
8) Transfer to kinetic energy of the atom or molecule.

If (1) can be done, then the action is performed.
If not, the possible sequence of actions continues.

If (2) can be done, then the action is performed.
If not, the sequence continues.
If (3) can be done, then the action is performed.
If not, the sequence continues.
If (4) can be done, then the action is performed.
If (5) can be done, then the action is performed.
If (6) can be done, then the action is performed.
If (7) can be done, then the action is performed.
Action (7 or 8) must be done, if no other.

Energy must be transferred, as in (1,2,3.4,5,6,7), or transformed, as in (8).
Actions (1,2,5) absorb only some of the incoming energy but the total energy is conserved through the partial transfer.

Action (1) has two requirements. First, the atom’s outer shell must have enough electrons because 2 will be ejected.

Descriptions of this action do not list the elements tested for this action.

The second requirement is the atom’s state of matter.
The description of its observations mention a “cloud chamber” implying this action has been observed only with unbound atoms in a gas.

Because the descriptions of this action lack all the necessary details, it is impossible to thoroughly explain its requirements. The mechanism can be explained. That explanation is in section 6.

Action (2) can occur in any state. If the radiation in its continuum has the energy for the outer shell to eject an electron, then in that instant, the energy is transferred to the ejected electron’s kinetic energy.

Electromagnetic radiation continues its propagation until either absorbed or transferred.

Action (3) is described separately below. This is a behavior on a surface.

Action (4) is described separately in section 5.

Action (5) occurs in an atom or molecule in a gas.

The atom can be neutral or ionized, but must have at least one electron. Doppler effect was explained earlier in this section 11.

Actions (3,4,6,7) can occur in a liquid or solid surface.

Action (8) is an instantaneous transfer of energy from the wavelength to the particle's kinetic energy.

Thermal energy in a gas is held in the kinetic energy of its particles. Pressure and volume also affect the temperature of a gas.

5.9 Compton Scattering

Compton scattering is an atomic behavior involving the absorption of energy at a level between that required for particle pair production and the photoelectric effect.

Excerpt from Wikipedia:

Compton scattering, discovered by Arthur Holly Compton, is the scattering of a photon by a charged particle, usually an electron. If it results in a decrease in energy (increase in wavelength) of the photon (which may be an X-ray or gamma ray photon), it is called the Compton effect. Part of the energy of the photon is transferred to the recoiling electron. Inverse Compton scattering occurs when a charged particle transfers part of its energy to a photon.

Compton found that some X-rays experienced no wavelength shift despite being scattered through large angles; in each of these cases the photon failed to eject an electron. Thus the magnitude of the shift is related not to the Compton wavelength of the electron, but to the Compton wavelength of the entire atom, which can be upwards of 10000 times smaller. This is known as "coherent" scattering off the entire atom since the atom remains intact, gaining no internal excitation.

In Compton's original experiments the wavelength shift given above was the directly-measurable observable. In modern experiments it is conventional to measure the energies, not the wavelengths, of the scattered photons.

(Excerpt end)

Observation:

This behavior is assumed to be an interaction between a photon and an electron, and also claimed to be confirmation of light as a particle, the photon, and not a wavelength.

This claim of a photon is an outright contradiction to Compton's conclusion the emitted wavelength is determined by the "entire atom."

There is no photon interacting with a free charged particle. An atom's outer shell electrons are absorbing the energy required to change its energy to one which is exactly acceptable as defined by the atom and its electrons.

This behavior is the intermediate result between the other energy levels for the atom. Photoelectric effect results in an electron ejection, with the excess energy transferred to the departing electron.

The explanation for Compton scattering requires the atom absorb the necessary energy, for this action to complete among its electrons. The set must increase the energy level held among them. That energy must be released when the atom returns to its ground state.

Unlike the photoelectric effect having 1 action, at this higher energy level of Compton scattering, the atom performs 2 electron actions.

1) 1 electron is ejected.

2) A second electron moved to ground state resulting in the radiation for that change in its energy. This charge moved a very short distance resulting in a very short emission line.

The description states this wavelength change is not quantized.

Excerpt from above:

“The wavelength shift is at least zero and at most twice the Compton wavelength of the electron.”

The Wikipedia image and description of Compton’s experiment in 1923 shows a “graphite target” suggesting the target’s surface having a lattice of carbon. Carbon has 6 electrons. There is no mention of a list of the other elements having this behavior measured with consistent results.

By comparison, the higher energy particle pair production (PPairP) also affects 2 electrons in the atom.
The difference between them is PPairP ejects the second electron as a positron, while CS gets a wave length, higher energy than that absorbed by the atom, from the non-ejected electron.

Compton scattering (CS) is a wavelength not a photon behavior.

5.9 Reflection

After light is emitted, it continues its propagation until absorbed.

Some surfaces, having the lattice structure of condensed matter can absorb and re-emit the incoming energy.

This action is observed with the surface of water or glass.

A mirror has the reflective surface behind the transparent glass.

The transparent glass has a suitable diffraction index, so the velocity of light's propagation slows through the glass without being absorbed. If the light encounters the glass surface at an angle, its path will bend accordingly by the change in diffraction index in the path within the glass

After passing through the glass, the propagation is affected by the current medium. When the back surface behind the glass is a solid or condensed matter, so it is not transparent, it will absorb and re-emit the light when composed of the correct elements in its lattice. A shiny metallic element is often used for the back of a mirror.

5.10 Molecular Vibration

Excerpt from Wikipedia:

A molecular vibration is a periodic motion of the atoms of a molecule relative to each other, such that the center of mass of the molecule remains unchanged. The typical vibrational frequencies, range from less than 1013 Hz to approximately 1014 Hz, corresponding to wavenumbers of approximately 300 to 3000 cm−1.
In general, a non-linear molecule with N atoms has 3N – 6 normal modes of vibration, but a linear molecule has 3N – 5 modes, because rotation about the molecular axis cannot be observed. A diatomic molecule has one normal mode of vibration, since it can only stretch or compress the single bond. Vibrations of polyatomic molecules are described in terms of normal modes, which are independent of each other, but each normal mode involves simultaneous vibrations of different parts of the molecule.
A molecular vibration is excited when the molecule absorbs energy, ΔE, corresponding to the vibration's frequency, v, according to the relation ΔE = hv, where h is Planck's constant. A fundamental vibration is evoked when one such quantum of energy is absorbed by the molecule in its ground state. When multiple quanta are absorbed, the first and possibly higher overtones are excited.

(Excerpt end)

The point here is energy must be transferred or transformed but must be conserved in all events.

The excerpt contains Lori Gardi’s change to Planck’s equation described in the Electromagnetism section.

6 Photoelectric Effect

The photoelectric effect apparently resulted in the concept of a photon particle.

Excerpt from Wikipedia:

The photoelectric effect is the emission of electrons when electromagnetic radiation, such as light, hits a material. Electrons emitted in this manner are called photoelectrons.

The experimental results instead show that electrons are dislodged only when the light exceeds a certain frequency—regardless of the light's intensity or duration of exposure. Because a low-frequency beam at a high intensity could not build up the energy required to produce photoelectrons like it would have if light's energy was coming from a continuous wave, Albert Einstein proposed that a beam of light is not a wave propagating through space, but a collection of discrete wave packets, known as photons.

In 1905, Einstein proposed a theory of the photoelectric effect using a concept first put forward by Max Planck that light consists of tiny packets of energy known as photons or light quanta. Each packet carries hv energy that is proportional to the frequency v of the corresponding electromagnetic wave. The proportionality constant h has become known as the Planck constant.

The maximum kinetic energy K_{max} of the electrons that were delivered this much energy before being removed from their atomic binding is

$K_{max} = hv - W$

where W is the minimum energy required to remove an electron from the surface of the material.
Einstein's formula, however simple, explained all the phenomenology of the photoelectric effect, and had far-reaching consequences in the development of quantum mechanics.

(Excerpt end)

Observation:

Einstein described the phenomena but he did not justify a photon particle.

The energy requirement is defined by the atom.

The quantized behavior is in the atom, not in the light.

This is like a baby accepts only a mouthful of milk from the bottle. The amount in a mouthful is defined by the baby, not by the milk or the bottle.

Light is a continuous stream of energy not a collection of discrete wave packets.

Visible Light is a continuum of frequencies, essentially from violet to red. There are no discrete increments anywhere in this continuum of energy.

Our eyes see the combination of certain frequencies as white. Human eyes are not sensitive to only certain discrete packets.

There are no photons. Quantum mechanics just calls a wavelength a photon.
However, wave lengths have no defined increment but span a continuum of values in whatever units are used, like Angstroms. The units selected for a measurement cannot define a behavior.

7 Doppler Effect

Excerpt from Britannica:

Doppler effect, the apparent difference between the frequency at which sound or light waves leave a source and that at which they reach an observer, caused by relative motion of the observer and the wave source. This phenomenon is used in astronomical measurements.

(Excerpt end)

The Doppler Effect is observed by the entire spectrum of the light source being shifted in proportion to the source's velocity in that direction.
The velocity of light is set by the medium. The velocity of light cannot be affected by the light source velocity. However, the source in motion affects the distribution of the radiated energy, not its velocity.

The timing of the Doppler Effect is crucial when one observes a spectrum shift in radiation from distant objects.

The Doppler Effect occurs only at the moment of radiation emission, when the motion of the object at that instant affects the spectrum.

There are 2 sources of electromagnetic radiation affected by the Doppler Effect: stars and atoms. Each initiates the propagation of the synchronized electric and magnetic fields. This propagation is an expanding sphere from the source. This sphere of energy continues until it is absorbed by an object in its path.

Stars emit a broad spectrum of thermal radiation.

Atoms emit a characteristic wavelength based on the electron configuration.

The energy being lost in the atom is transferred to the corresponding wavelengths of electromagnetic radiation. Some atoms emit more than one wavelength when dropping to their ground state.

These wavelengths can be observed and measured in a spectrum, and are called emission lines.

At the instant of radiation emission, the motion of the source affects the wavelength distribution around that sphere. Wavelengths in the direction of the source are changed by an amount proportional to the source's velocity relative to the velocity of light. The light source is generating a continuum of energy as a sphere. Wave lengths in one side of the sphere will be reduced, or toward the blue end, in the direction of the source. Wave lengths in the other side of the sphere will be increased, or toward the red end, in the direction opposite of the source. There is perfect symmetry with the change in wavelength on one side exactly matched by the change on the opposite side. The sphere is a continuum of energy, being carried in wave lengths. There is definitely no quantized behavior present.

The motion of the light source does not change the amount of energy being radiated, only its distribution around the sphere of its propagation. Energy is always conserved.

The Doppler Effect also occurs only at the moment of radiation absorption, when the motion of the object at that instant also affects the spectrum. When energy is absorbed by an object than that energy is missing from the radiation. The energy is carried in wave lengths so those wave lengths carrying the energy which was transferred to the object are missing in the spectrum. These missing wave lengths are called absorption lines.

Absorption lines arise from objects in the line of sight, between the light source which emits the intact energy or spectrum.

The absorption line behavior is affected by the velocity of the atom. A moving atom carries kinetic energy and that energy participates in the transfer of energy from the radiation to the atom. As with an emission line, the velocity of the atom relative to the velocity of light determines the energy involved.

An atom is essentially a tiny sphere. An atom in the path of electromagnetic radiation can absorb energy from that energy. The atom's motion relative to the radiation is important. The motion at that point in the sphere will have a proportion relative to the velocity of light and relative to the direction of the incoming light.

When the atom is moving toward the light source the kinetic energy of the atom is a participant and it reduces the energy the atom requires and absorbs from the radiation. This decrease in energy is a higher wavelength.

Energy is always conserved during this exchange.

When the atom is moving away from the light source the kinetic energy of the atom is a participant and it increases the energy the atom requires and absorbs from the radiation. This increase in energy is a lower wavelength.
The energy being absorbed is noted as an absorption line wavelength.

This is the simple calculation of z.

The velocity, called v here, of the source is compared to the velocity of light by dividing that value by the velocity of light, called the constant c.

The value of v has a sign. Doppler Effect is in the observer's line of sight. When the object is moving away from the observer, v is + or positive, and when moving toward the observer, v is – or negative.

The result is called z by convention.

The simple equation is $z=v/c$, making sure the units are the same (usually km/s).

The shift in a spectrum due to the motion of the light source is a simple equation, where EWL is the emission wavelength,

NWL is the new wavelength, so:
NWL = EWL + (EWL multiplied by z)

where the z is the factor for the change in the new wavelength from that originally emitted; z is positive for a red shift or negative for a blue shift.

There is no quantized behavior in any of the equation's factors or in the result.

6.1 First Doppler shifts

Excerpt from Wikipedia:

(Excerpt end)

Observation:

7.1 Galaxy Red Shift

The spectrum of some galaxies in our Local Group, M31 and M33, exhibit a unique behavior, a blue shift, not a redshift as seen in distant galaxies. In 1936, Edwin Hubble noticed this and put our Local Group on an island separate from the Hubble Flow.

The M31 galaxy spectrum has the pair of calcium ion absorption lines which are shifted toward the blue. This measurement of M31 was done by Vesto Slipher in 1914.

This unusual blue shift should have revealed to astronomers a possible problem measuring redshifts.

The solar wind was not measured until space probes were launched with the necessary equipment. By the 1990's, the SOHO craft could monitor solar activity.
The slow solar wind velocity is 300-500 km/s while the fast solar wind is 750 km/s.

Slipher measured the M31 calcium ions at -400 km/s. Negative means away from the M31 galactic corona and toward Earth. This is the same velocity of calcium ions in the slow solar wind moving away from the solar corona.

Just as the solar wind velocity is not the Sun's velocity, the calcium ions moving away from M31 do not indicate the M31 velocity.

Slipher could not know of the solar wind, but modern cosmologists should know. There are intermittent sensational news stories about the eventual collision between our Milky Way, M31, and M33. These stories are nonsense, but are justified by the wrong accepted velocity of the galaxies.

Many galaxies are measured using the neutral hydrogen emission line.

By mistake, this neutral hydrogen emission line red shift was considered the result of a velocity causing a Doppler effect. This is only a line of sight behavior and indicates nothing about the distant galaxy's actual velocity. This mistake caused many others, including the universe expansion, dark energy, and the Big Bang.

7.2 Quasar Red Shift

A quasar is a distant object which looks like a star, but it has a strong source of synchrotron radiation, extending from radio to X-ray. All quasars share red-shifted emission lines from a variety of non-hydrogen elements where the mix can vary by quasar because the mix comes from the Seyfert during the ejection of the plasmoid. All quasars share the same red shifted hydrogen Lyman-alpha emission line.

Some quasars can have this line with a red shift indicating the atom is moving at many multiples of the speed of light, like 7x. A proton when capturing an electron emits this wavelength. The wavelength is shifted by the proton's velocity at the instant of that capture. This red shift comes from the atom moving toward the plasmoid in the line of sight, and indicates nothing about the quasar's actual velocity. This mistake with a velocity compounds the galaxy red shift mistake, so both objects having a different mechanism make the false dark energy difficult to explain both false velocities. Halton Arp had observed and described in his book Seeing Red that a nearly adjacent galaxy and quasar would have a higher redshift always with the quasar, and the galaxy redshift was lower than the quasar. Arp apparently did not know, just like other astronomers who were also surprised by the combination that the galaxy and quasar measurements were of different mechanisms.

Also, a quasar's hydrogen red shift of $z > 1$ indicates a proton's velocity is exceeding that of light. Einstein developed the theory of relativity assuming mass cannot travel faster than c. His assumption was shown to be a mistake by many quasars. Relativity has too many mistakes.

A quasar has two redshifts. All of the metallic ions have a similar redshift of their emission line from capturing an electron, apparently moving at the same rate as could occur in a plasma filament. The second redshift is from the high-velocity proton capturing an electron while moving toward the quasar's plasmoid.

M87 is known to eject plasma jets at a velocity exceeding c. If protons ejected from M87 are captured by a quasar, the result is a high redshift Lyman-alpha emission line. When its z is very high, this line can shift from ultraviolet where it is when at rest, to infrared. With that shift some astronomers can miss it, especially if the equipment or spectrogram cuts off at a wavelength before this emission line, which is much longer wavelength than the rest. There might be more quasars at z >1 if this line has been missed.

6 Photoelectric Effect

The photoelectric effect apparently resulted in the concept of a photon particle.

Excerpt from Wikipedia:

The photoelectric effect is the emission of electrons when electromagnetic radiation, such as light, hits a material. Electrons emitted in this manner are called photoelectrons.

The experimental results instead show that electrons are dislodged only when the light exceeds a certain frequency—regardless of the light's intensity or duration of exposure. Because a low-frequency beam at a high intensity could not build up the energy required to produce photoelectrons like it would have if light's energy was coming from a continuous wave, Albert Einstein proposed that a beam of light is not a wave propagating through space, but a collection of discrete wave packets, known as photons.

In 1905, Einstein proposed a theory of the photoelectric effect using a concept first put forward by Max Planck that light consists of tiny packets of energy known as photons or light quanta. Each packet carries hv energy that is proportional to the frequency v of the corresponding electromagnetic wave. The proportionality constant h has become known as the Planck constant.

The maximum kinetic energy K_{max} of the electrons that were delivered this much energy before being removed from their atomic binding is

$K_{max} = hv - W$

where W is the minimum energy required to remove an electron from the surface of the material.
Einstein's formula, however simple, explained all the phenomenology of the photoelectric effect, and had far-reaching consequences in the development of quantum mechanics.

(Excerpt end)

Observation:

Einstein described the phenomena but he did not justify a photon particle.

The energy requirement is defined by the atom.

The quantized behavior is in the atom, not in the light.

This is like a baby accepts only a mouthful of milk from the bottle. The amount in a mouthful is defined by the baby, not by the milk or the bottle.

Light is a continuous stream of energy not a collection of discrete wave packets.

Visible Light is a continuum of frequencies, essentially from violet to red. There are no discrete increments anywhere in this continuum of energy.

Our eyes see the combination of certain frequencies as white. Human eyes are not sensitive to only certain discrete packets.

There are no photons. Quantum mechanics just calls a wavelength a photon.
However, wave lengths have no defined increment but span a continuum of values in whatever units are used, like Angstroms. The units selected for a measurement cannot define a behavior.

7 Doppler Effect

The Doppler Effect is a critical observation in cosmology.

Excerpt from Britannica:

Doppler effect, the apparent difference between the frequency at which sound or light waves leave a source and that at which they reach an observer, caused by relative motion of the observer and the wave source. This phenomenon is used in astronomical measurements.

(Excerpt end)

The Doppler Effect is observed when the entire spectrum of the light source has shifted in proportion to the light source's velocity in that direction.
The velocity of light is always set by the medium. The velocity of light cannot be affected by the light source velocity. However, the source in motion affects the distribution of the radiated energy, never its velocity.

The timing of the Doppler Effect is crucial when one observes a spectrum shift in radiation from distant objects.

The Doppler Effect occurs only at the moment of radiation emission, when the motion of the object at that instant affects the spectrum.

There are 2 sources of electromagnetic radiation affected by the Doppler Effect: stars and atoms.

Stars emit thermal radiation, where the distribution of energy across its range of wavelengths is related to the temperature of the heat source. Stars emit their energy in the range from ultraviolet to infrared, so an eye is sensitive to part of that range in what is called visible light.

An ion emits a characteristic wavelength, when capturing an electron and the atom becomes neutral. If the ion is in motion, its kinetic energy participates in the energy transfer, observed as a shift in the wavelength proportional to the ion’s velocity relative to the velocity of light.

Similarly, an atom or ion can absorb a characteristic wavelength, when transferring energy to its electrons, or to its internal energy state. If the atom or ion is in motion, its kinetic energy participates in the energy transfer, observed as a shift in the absorption line’s wavelength proportional to the atom’s velocity relative to the velocity of light.

The star’s thermal radiation or an atom’s emission line initiates the propagation of the synchronized electric and magnetic fields. This propagation is an expanding sphere from the source. This sphere of energy continues until it is absorbed by an object in its path.

Stars emit a broad spectrum of thermal radiation. The energy distribution among the wavelengths is driven by the object’s temperature, which a measurement of the internal molecular vibrations. The nuclei are electrical charges in motion, though within a very small range.

Atoms emit a characteristic wave length based on the electron configuration.

The energy being lost in the atom is transferred to the corresponding wave lengths of electromagnetic radiation. Some atoms emit more than one wave length when dropping to their ground state.

These wave lengths can be observed and measured in a spectrum, and are called emission lines.

The instant of radiation emission, the motion of the source affects the wave length distribution around that sphere. Wave lengths in the direction of the source are changed by an amount proportional to the sources velocity relative to the velocity of light. The light source is generating a continuum of energy as a sphere. Wave lengths in one side of the sphere will be reduced, or toward the blue end, in the direction of the source. Wave lengths in the other side of the sphere will be increased, or toward the red end, in the direction opposite of the source. There is perfect symmetry with the change in wavelength on one side exactly matched by the change on the opposite side. The sphere is a continuum of energy, being carried in wavelengths. There is definitely no quantized behavior present.

The motion of the light source does not change the amount of energy being radiated, but only its distribution around the sphere of its propagation. Energy is always conserved.

The Doppler Effect also occurs only at the moment of radiation absorption by an atom, when the motion of the atom at that instant also affects the spectrum. When energy is absorbed by an atom than that energy is missing from the radiation, observed by a line missing from the continuum. The energy is carried in wave lengths so those wave lengths carrying the energy which was transferred to the object are missing in the spectrum from the light source. These missing wave lengths are called absorption lines.

Absorption lines arise from atoms in the line of sight, between the light source which emits the intact energy or spectrum.

The absorption line behavior is affected by the velocity of the atom. A moving atom carries kinetic energy and that energy participates in the transfer of energy from the radiation to the atom. As with an emission line, the velocity of the atom relative to the velocity of light determines the amount of energy involved in the exchange.

An atom is essentially a tiny sphere. An atom in the path of electromagnetic radiation can absorb energy from that continuum of energy. The atom's motion relative to the radiation is important. The motion at that point in the sphere will have a proportion relative to the velocity of light and relative to the direction of the incoming light.

When the atom is moving toward the light source the kinetic energy of the atom is a participant and it reduces the energy the atom requires and absorbs from the radiation. This decrease in energy is a higher wave length.

Energy is always conserved during this exchange.

When the atom is moving away from the light source the kinetic energy of the atom is a participant and it increases the energy the atom requires and absorbs from the radiation. This increase in energy is a lower wavelength.
The energy being absorbed is noted as an absorption line wavelength.

7.1 Doppler Calculations

This is the simple calculation of z.

The velocity, called v here, of the source is compared to the velocity of light by dividing that value by the velocity of light, called the constant c.

The value of v has a sign. Doppler Effect is in the observer’s line of sight. When the object is moving away from the observer, v is + or positive, and when moving toward the observer, v is – or negative.

The result is called z by convention.

The simple equation is z=v/c, making sure the units are the same (usually km/s).

The shift in a spectrum due to the motion of the light source is a simple equation, where EWL is the emission wavelength,

NWL is the new wavelength, so:
NWL = EWL + (EWL multiplied by z)

where the z is the factor for the change in the new wavelength from that originally emitted; z is positive for a red shift or negative for a blue shift.

There is no quantized behavior in any of the equation’s factors or in the result.

7.2 Galaxy Red Shift

7.2.1 Lyman-Alpha emission

The spectrum of galaxies beyond our Local Group exhibit a unique behavior. In 1936, Edwin Hubble noticed this and put our Local Group on an island separate from the Hubble Flow.

These galaxies have a Lyman-alpha emission line which shifts toward the red, and this shift is roughly proportional to the galaxy’s distance from the observer, who is always on or near the Earth.

The explanation for the line shift is protons are moving faster toward remote galaxies beyond our Local Group of galaxies. The lyman-alpha wavelength is emitted when a proton captures an electron to become a hydrogen atom.

7.2.2 Neutral hydrogen emission

Neutral hydrogen atom emits a wavelength at 21cm.

Being neutral, these atoms are pulled by gravity toward the nearest galaxy, so they are moving away from Earth and the line is redshifted. This red shift is from the atom in the ne of sight, not the light source.

By mistake, this neutral hydrogen emission line red shift was considered the result of a velocity causing a Doppler effect. This is only a line of sight behavior and any line indicates nothing about the distant galaxy's actual velocity. This mistake caused many others, including the universe expansion, dark energy, and the Big Bang.

Improving imaging technology enables a spectrum to be captured from galaxies which had been too dim by their distance.

7.3 Quasar Red Shift

A quasar is a distant object which looks like a star but it has a strong source of synchrotron radiation, extending from radio to X-ray, All share red-shifted emission lines from a variety of non-hydrogen elements where the mix can vary by quasar. All share the same red shifted hydrogen Lyman-alpha emission line.

These quasars can have this line with a red shift indicating the atom is moving at many multiples of the speed of light, like 7x. A proton when capturing an electron emits this characteristic wavelength. The wavelength is shifted by the proton's velocity at the instant of that capture. This red shift comes from the atom in the line of sight, and indicates nothing about the distant quasar's actual motion. This mistake compounds the galaxy red shift mistake, so both objects have a different mechanism. This makes the false dark energy difficult to explain both false velocities.

Also, a quasar's hydrogen red shift of $z > 1$ indicates a proton's velocity is exceeding that of light. Einstein developed the theory of relativity assuming mass cannot travel faster than c. His unjustified assumption was shown to be a mistake by many quasars. Relativity has too many mistakes.

Halton Arp in his work with quasars failed to recognize a quasar has 2 red shifts. His book Seeing Red, even has 2 spectrograms illustrating that dual behavior, but Arp always used 1 of 2 z values, the lower, in his descriptions. This was not deception.

He clearly was unaware of the mechanisms being measured for the values of galaxy and quasar, and it appears others gave him the redshift value rather personally calculating it. He catalogued his observations without having to do the calculations. If Arp was aware of 2 red shifts his book would have reached different conclusions. Arp is noted for his extensive observations including his well-known compilation of peculiar galaxies.

Many others do not understand the redshift mechanisms.

An annotated quasar spectrum, from Caltech, was included in the section Quasar.

7.4 Red shift summary

The term "redshift" is used so loosely, most think of it as just a simple number having a consistent meaning, like a temperature.

A red shift is not that simple and anyone using the term so loosely is showing they consider it as just a simple number.

It is crucial to recognize there are 4 different red shifts. Each is a measurement of a distinct behavior.

Galaxies are totally different entities than quasars. A galaxy has billions of stars while a quasar is a quasi-stellar object having no stars.

A quasar's red shift can come from only emission lines from ions capturing electrons. Absolutely none of these emission lines indicate anything about the quasar.

Similarly, a galaxy's measured red or blue shift can only be in absorption or emission lines from atoms in the line of sight. Each shift is measured as a change, a dimensionless value called z. It is a mistake to call this measurement one of velocity.

If Astronomers used z not km/s for their velocity measurement, then the illusion of their false motion would have been prevented.

As noted earlier, a metallic element is one which is not hydrogen or helium.

The 5 distinct red shifts:

1) Galaxy – hydrogen absorption (several)

2) Galaxy – hydrogen emission lines (several)

3) Galaxy – metal

4) Quasar – hydrogen emission line

5) Quasar – metal

Shift (1): There are several hydrogen absorptions lines. The single electron orbiting the single proton can take 1 of many orbits, or energy states. The first 2 sets have been defined as the Lyman and Balmer series; there are more series. The Lyman-alpha absorption line is at 1216 Angstroms. Any absorption lines must be from atoms in the line of sight and are not from the galaxy. This book will ignore other hydrogen lines, like from the Balmer series.
The hydrogen absorption line is rarely if ever observed in the spectrum of a galaxy.

Shift (2): There are at least 2 hydrogen emission lines, the Lyman-alpha line at 1216 Angstroms, and the neutral hydrogen line at 21 cm. Both lines must be from atoms in the line of sight and are not from the galaxy. This book will ignore other hydrogen lines, like from the Balmer series.

Shift (3): A notable example of a metallic line is the blue shift in M31, Andromeda galaxy. The calcium ion absorption line is driven by calcium ions near the galactic corona. Calcium is a metal. The metallic line originates in the ion but not in the light source, the galaxy.

Shift (4): The quasar high red shift comes from the hydrogen Lyman-alpha emission line.

Shift (5): The quasar low red shift comes from the metallic ion emission lines.

Shift (1): This line can never be a galaxy velocity.

Shift (2): There are galaxies with either a red or blue shift of the metallic ion absorption lines. M31 has a calcium line blue shifted. This can never be a galaxy velocity, nor can it be related to a galaxy distance. Only a Cepheid provides a distance metric.

LINER galaxies, which include Seyferts, exhibit several metallic elements when taking the spectrum of their AGN. None of these metallic lines in a LINER galaxy spectrum are related to the galaxy’s motion.

Shift (4): The hydrogen Lyman-alpha emission line is found in a "typical" quasar. This can never be a quasar velocity, nor can it be related to a quasar distance.

Shift (5): These metallic lines are found in the quasars used by Halton Arp, in his book Seeing Red. This red shift can never be a quasar velocity, nor can it be related to a quasar distance, nor can it be related to the age of matter. These ions just slow down in apparent incremental changes in their velocity, as other ions captured an electron and became neutral, or no net charge.

The z value for (4) has exceeded 7, while the z value for (5) is < 1.

It is crucial to note that none of the 5 types of a red shift is an indicator of the object's real velocity.
None of the redshifts have a useful application.

Regardless of a useful application, all 4 types are defined to prevent a wrong application.

No red shift is a velocity, except with an atom or star. Galaxies and quasars are neither. When one accepts that simple fact about the false velocities, then there is no "Hubble Flow." That was the term Edwin Hubble used initially for the red shift trend.

Dark energy arose from the wrong assumption that the false expansion is consistent.

There is no expansion, no dark energy, and no big bang.

7.5 High Redshifts

All galaxies and quasars having a high redshift of $z > 1$ share the same mechanism being measured, the Lyman-alpha emission line.

This line occurs when a proton captures an electron. The velocity of the proton at that instant causes the line to shift by the proton's velocity and direction.

Quasars with a $z > 8$, and galaxies with $z > 11$ have been measured. The tiny mass proton can move faster than the velocity of light. This can be accomplished easily when a positive proton moves through and is accelerated by a sustained magnetic field.

The velocity of the proton has nothing to do with the velocity of a quasar, or of a galaxy having millions of stars.

The velocity of the proton and its redshift have nothing to do with the distance to the galaxy or quasar. Currently, they are assigned an incredible c-moving distance where the fabric of space is stretching faster than the speed of light causing an illusion of an object moving faster than light. . The confusion directly affected the mistake of universe expansion and an expanding fabric of space. This proposed a stretching fabric could stretch the light propagating on it. This is utter nonsense for an explanation when only the Lyman-alpha line is shifted, not the entire spectrum.

Hubble's Law arose from only a few galaxies measured before 1926. It should have been ignored a long time ago, but cosmology does not self-correct so the confusion between redshift and distance remains a century later.

7.6 Atoms and Stars

Atoms and stars are not in the list with galaxies and quasars.

An atom generating an emission line is a light source so its motion results in a true Doppler effect.

Similarly, an atom absorbing its characteristic wavelength has its kinetic energy participate in the energy transfer so its motion results in a true Doppler effect for its absorption line. The Doppler effect was verified in experiments using atoms.

The wobble method for an exoplanet search relies on the primary star having planets will exhibit the Doppler effect. An analysis of this cycle, using Kepler's laws of planetary motion, enables finding the mass and orbits of the respective exoplanets.

A star's photosphere is a light source, so the star's motion results in a true Doppler effect. A Star and its planets rotate around the system's center of gravity. This shift of the star's entire spectrum can be measured.

Most exoplanets are found by their blocking some of the light from their star when their orbit takes them in the line of sight to the star.

7.7 Cosmological Red Shift

Cosmological redshift is the result of trying to explain a high redshift value without understanding of the mechanism driving that value. Cosmological redshift proposes an entire spectrum shift to solve the problem of high redshifts. Unfortunately, this proposal causes the loss of energy from the light or as violation of thermodynamics. This is a mistake, not a solution.

Cosmological red shift simply ignores the mechanisms driving an individual redshift change in an object's spectrum.

Excerpt from SAO Encyclopedia of Astronomy:

Laboratory experiments here on Earth have determined that each element in the periodic table emits photons only at certain wavelengths (determined by the excitation state of the atoms). These photons are manifest as either emission or absorption lines in the spectrum of an astronomical object, and by measuring the position of these spectral lines, we can determine which elements are present in the object itself or along the line of sight.

However, when astronomers perform this analysis, they note that for most astronomical objects, the observed spectral lines are all shifted to longer (redder) wavelengths. This is known as ‘cosmological redshift’ (or more commonly just ‘redshift’).

(Excerpt end)

Observation:

There is a very big mistake in this description.
The phrase “the observed spectral lines are all shifted to longer wavelengths” is absolutely wrong.

With galaxies, there is only 1 specific emission line being affected in the spectrum, either Lyman-alpha or neutral hydrogen. “All” is definitely not one.

In a cosmological redshift, all wavelengths from the source are lengthened as the light travels through (supposedly expanding) space. Cosmological redshift results from the expansion of space itself and not from the motion of an individual body.

The galaxy spectrum at its source has no absorption or emission lines. All lines originate in the line of sight. They should never be used for the galaxy's velocity.

The SAO just ignores what has been known since the 1930's, the single neutral hydrogen emission line shifts in a rough proportion to its distance. Hubble's Law is based on the change in one specific wavelength, not the entire spectrum.

This cosmological redshift is a big mistake by ignoring how red shifts are measured.

Cosmological redshift violates the conservation of energy.

The reason:

The Doppler Effect at the moment of emission or absorption does not gain or lose energy. The Doppler Effect is either a transfer of energy or a change in its distribution within the sphere radiating from the source.

blue shift or red shift at any other time is a change in the radiation energy with no identified partner for a transfer. This is a violation of conservation of energy because the energy transfer is undefined, so the energy is not conserved. A red shift is loss of energy. A blue shift is a gain of energy.

A red shift of all wavelengths is a loss of energy. This cannot happen. This cosmological redshift is a mistake for more than one reason.

Explanations of this change in the propagation of light from expanding space are cryptic.

Excerpt from Wikipedia:

The red shifts of galaxies include both a component related to recessional velocity from expansion of the universe, and a component related to peculiar motion (Doppler shift).The redshift due to expansion of the universe depends upon the recessional velocity in a fashion determined by the cosmological model chosen to describe the expansion of the universe, which is very different from how Doppler red shift depends upon local velocity.

Describing the cosmological expansion origin of redshift, cosmologist Edward Robert Harrison said, "Light leaves a galaxy, which is stationary in its local region of space, and is eventually received by observers who are stationary in their own local region of space. Between the galaxy and the observer, light travels through vast regions of expanding space.

As a result, all wavelengths of the light are stretched by the expansion of space. It is as simple as that..." Steven Weinberg clarified, "The increase of wavelength from emission to absorption of light does not depend on the rate of change of a(t) [here a(t) is the Robertson–Walker scale factor] at the times of emission or absorption, but on the increase of a(t) in the whole period from emission to absorption."

Popular literature often uses the expression "Doppler redshift" instead of "cosmological redshift" to describe the redshift of galaxies dominated by the expansion of spacetime, but the cosmological redshift is not found using the relativistic Doppler equation which is instead characterized by special relativity; thus v > c is impossible while, in contrast, v < c is possible for cosmological redshifts because the space which separates the objects (for example, a quasar from the Earth) can expand faster than the speed of light. More mathematically, the viewpoint that "distant galaxies are receding" and the viewpoint that "the space between galaxies is expanding" are related by changing coordinate systems. Expressing this precisely requires working with the mathematics of the Friedmann–Robertson–Walker metric.

If the universe were contracting instead of expanding, we would see distant galaxies blue shifted by an amount proportional to their distance instead of red shifted.

(Excerpt end)

Observation:

The cosmological redshift comes from assumption in the cosmological model and “precisely working with the mathematics of the Friedmann–Robertson–Walker metric.”

It is odd for someone to say
“It is as simple as that..." when this calculation is not simple as it is based on so many unfounded assumptions, including the cosmological model. The universe expansion arose from mistakes with red shifts. The model accepts that mistake.

The lack of communication among cosmologists has been demonstrated by relevant studies.

Recent studies of galaxies with high red shifts concluded the red shifts were from hydrogen in the intergalactic medium, not from a galaxy velocity. Galaxies are not moving at more than 8 times the velocity of light.

When those studies are unknown or ignored, then the cosmological redshift is still proposed for the extreme red shifts wrongly assumed to remain unexplained.

6.7 Cosmic Microwave Background

The CMB is a controversial topic with some claiming it was detected, with others disagreeing.

One in disagreement is Pierre-Marie Robitaille, an expert in signal to noise problems.

He produced a series of YouTube videos on the topic of CMB for his Sky Scholar channel.

For the scope of this book, his conclusions are accepted. Thermal radiation requires a physical surface. The void of the observable universe cannot exhibit a temperature. The assumption that the radiation occurred many billions of years ago, only to be detected now is just conjecture. There is no CMB, so anything based on it is mistaken. The instruments were recording the signal from Earth’s oceans, not from a fictitious, very distant source.

CMB is sometimes mentioned as a basis for measuring galaxies. That practice is a mistake, and this book expects those results are invalid.

8 Star Types

The internal mechanism driving a star's thermal radiation is not crucial to this book. However, the current gaseous Sun model is being questioned.

A new solar model was explained in the author's book Cosmology Transition.

Briefly, Pierre-Marie Robitaille developed a solar model based on condensed matter in the form of liquid metallic hydrogen. This is the term for a lattice of protons maintained by loose electrons. This lattice is electrically conductive and cools by emitting thermal radiation. This model explains all solar and stellar observations. He has presented this model in many venues including his YouTube channel, Sky Scholar. There are increasing numbers of scientists receptive to this solar model. The current gaseous solar model powered by fusion in its core fails to explain many observations. It persists despite those conflicts. Among the failures of the fusion model:

a) The mechanism for the observed thermal spectrum,
b) The internal distinct layers measured by helio-seismology,
c) The different rates of rotation by latitude of its perfect sphere,
d) Limb darkening,
e) The various events at the photosphere's liquid surface,
f) The mechanism for the solar wind.

All are explained by the model using condensed matter in the form of liquid metallic hydrogen which is a lattice of protons maintained by loose electrons. This lattice is electrically conductive, so it supports the observed electromagnetic phenomena, like sunspots.

One of the significant conclusions from the different efforts researching the mechanisms in the Sun is new elements are being created on the surface of the photosphere by the process of transmutation. This is not the mechanism of impossible pressures and temperatures which are required to sustain fusion of atomic nuclei for billions of years. Nearly all of the elements in the periodic table are found in the solar spectrum. They are being created in that complex electromagnetic environment capable of a great force of compression. This is not the ideal gas environment in an enclosed volume where pressure and temperature become related. No star possesses such a container.

The current star types are defined primarily by the measured surface temperature. That is how the Sun gets its assigned type. However, many types also reference the presence of specific elements in their spectrum. These elements are assumed to be present by the stage of the star's internal fusion cycle.

Now that the solar model is changing from internal fusion to surface transmutation, all assumptions based on the distribution of elements in a star's spectrum lose their validity. The ratio of elements is called metallicity and is used to draw conclusions on the age of collections of stars, like in galaxies or globular clusters. The result of these assumptions becoming invalid affects the many analyses based on them.

This book is about measuring galaxies, not stars, but some stars have a role in the process.

Changing the mechanisms in a star is a paradigm shift in cosmology.

This book will reference the 2 variable star types, Cepheid or RR Lyrae. Other types are less important to galaxies in general, though of course, galaxies have a mix of types.

These variable stars are among the brightest so their magnitude can be measured by telescopes having the necessary resolution.

There are other bright, giant stars, but the variable stars are much easier to identify in a series of images.

8.1 Cepheid

Cepheid is the most frequently used type of variable star.

Excerpt from Wikipedia:

A Cepheid variable is a type of star that changes in brightness with a well-defined stable period and amplitude.
A strong direct relationship between a Cepheid variable's luminosity and pulsation period established Cepheids as important indicators of cosmic benchmarks for scaling galactic and extragalactic distances.

This robust characteristic of classical Cepheids was discovered in 1908 by Henrietta Swan Leavitt after studying thousands of variable stars in the Magellanic Clouds.

This discovery allows one to know the true luminosity of a Cepheid by simply observing its pulsation period. This in turn allows one to determine the distance to the star, by comparing its known luminosity to its observed brightness.
The term Cepheid originates from Delta Cephei in the constellation Cepheus, identified by John Goodricke in 1784, the first of its type to be so identified. Chief among the uncertainties tied to the classical and type II Cepheid distance scale are: the nature of the period-luminosity relation in various passbands, the impact of metallicity on both the zero-point and slope of those relations, and the effects of photometric contamination (blending) and a changing (typically unknown) extinction law on Cepheid distances. All these topics are actively debated in the literature.
These unresolved matters have resulted in cited values for the Hubble constant (established from Classical Cepheids) ranging between 60 km/s/Mpc and 80 km/s/Mpc. Resolving this discrepancy is one of the foremost problems in astronomy since the cosmological parameters of the Universe may be constrained by supplying a precise value of the Hubble constant.

Delta Cephei is also of particular importance as a calibrator of the Cepheid period-luminosity relation since its distance is among the most precisely established for a Cepheid, partly because it is a member of a star cluster and the availability of precise Hubble Space Telescope / Hipparcos parallaxes. The accuracy of the distance measurements to Cepheid variables and other bodies within 7,500 lightyears is vastly improved by combining images from Hubble taken six months apart when the Earth and Hubble are on opposite sides of the Sun.

Excerpt from Wikipedia's cosmic distance ladder topic:

As detected thus far, NGC 3370, a spiral galaxy in the constellation Leo, contains the farthest Cepheids yet found at a distance of 29 Mpc. Cepheid variable stars are in no way perfect distance markers: at nearby galaxies they have an error of about 7% and up to a 15% error for the most distant.

(Excerpt end)

Observation:

The Cepheid has known limitations, but for a long time a variable star having a consistent luminosity curve was the only reliable method to determine a particular galaxy's distance, its host. Alternate methods have been developed in recent decades. Individual sections in this book will cover several of them.

The 7 to 15% error is very important. References for research, like Wikipedia, should indicate such details. When a distance comes from an average, the value lacking that detail implies precision, when there was none.

This practice can be inconsistent in Wikipedia. Its topics for the elements will sometimes include the % of each isotope to know exactly where the final value came from. Lacking those percentages could imply all the atoms of this element have the same atomic mass, which is wrong.

If the distance to a galaxy is the result of combining more than one possibility, then the value must also note this result.

For example, if multiple Cepheids have different distances, perhaps just averaging the set of numbers is incorrect. If the galaxy disk is at an angle, then the set of distances could enable calculating the angle of the disk as seen by the observer.

For example, if the value is the average of two, ignoring the two values and providing only the average is quite misleading about the value’s precision.

8.2 RR Lyrae

RR Lyrae is a type of variable star, like a Cepheid, but used less often.

Excerpt from Wikipedia:

RR Lyrae is a variable star in the Lyra constellation, figuring in its west near to Cygnus. As the brightest star in its class, it became the eponym for the RR Lyrae variable class of stars and it has been extensively studied by astronomers. RR Lyrae variables serve as important standard candles that are used to measure astronomical distances. The period of pulsation of an RR Lyrae variable depends on its mass, luminosity and temperature, while the difference between the measured luminosity and the actual luminosity allows its distance to be determined via the inverse-square law. Hence, understanding the period-luminosity relation for a local set of such stars allows the distance of more distant stars of this type to be determined.

The distance of RR Lyrae remained uncertain until 2002 when the Hubble Space Telescope's fine guidance sensor was used to determine the distance of RR Lyrae within a 5% margin of error, yielding a value of 262 parsecs (855 light-years). When combined with measurements from the Hipparcos satellite and other sources, the result is a distance estimate of 258 pc (841 ly).

(Excerpt end)

Using the RR Lyrae has known limitations, including a shorter usable distance range compared to the Cepheid. Alternate methods for a distance calculation have been developed in recent decades. Individual sections in this book will cover several.

8.3 Supernova

A nova is a star which brightens. A supernova is a star which gets extremely bright, often with no warning. They are rare, when considering the number of stars in galaxies.

Some astronomers attempted to find supernovae with a repeating luminosity curve. Because a supernova gets much brighter than a Cepheid, a class of supernova with a repetitive behavior could become another standard candle for galaxies too distant to have a Cepheid detected. This effort was awarded a Nobel Prize but this author was not impressed. This was covered in the early books. In short, the claimed supernovae with similar light curves were actually variable stars like Cepheids. None of the study's supernova had an abrupt brightening which is the expected behavior for that star type. The study had many other mistakes, including cosmological red shift.

If these astronomers revealed all the data of these variable stars, perhaps they could become useful. They might be Cepheids or a similar type. Now, the variable stars were assumed to be supernovae, so they are forgotten by this mistake.

If all the variable stars and their galaxies were analyzed again (perhaps requiring a new spectrum capture of the galaxies), discarding the mistakes and wrong assumptions, then these variable stars could provide useful data. This original study provided no useful conclusions.

8.4 Stellar Populations

The fusion model is the basis for other assumptions including a star’s life cycle.

These assumptions for the age of a particular star or group lead to estimates for the age of their galaxy, or even their globular cluster, which is essentially a small elliptical galaxy.

8.4.1 Population I

Excerpt from Wikipedia:

Population I, or metal-rich, stars are young stars with the highest metallicity out of all three populations, and are more commonly found in the spiral arms of the Milky Way galaxy. The Earth's Sun is an example of a metal-rich star and is considered as an intermediate Population I star, while the solar-like Mu Arae is much richer in metals.

Population I stars usually have regular elliptical orbits of the galactic centre, with a low relative velocity. It was earlier hypothesized that the high metallicity of Population I stars makes them more likely to possess planetary systems than the other two populations, because planets, particularly terrestrial planets, are thought to be formed by the accretion of metals. However, observations of the Kepler Space Telescope data have found smaller planets around stars with a range of metallicities, while only larger, potential gas giant planets are concentrated around stars with relatively higher metallicity — a finding that has implications for theories of gas giant formation. Between the intermediate Population I and the Population II stars comes the intermediary disc population.

(Excerpt end)

Observation:

The phrase “implications for theories of gas giant formation” indicates this model does not match the observed spectra.

8.4.2 Population I I

Excerpt from Wikipedia:

Population II, or metal-poor, stars are those with relatively little of the elements heavier than helium. These objects were formed during an earlier time of the universe. Intermediate Population II stars are common in the bulge near the centre of the Milky Way, whereas Population II stars found in the galactic halo are older and thus more metal-poor. Globular clusters also contain high numbers of population II stars.
A characteristic of Population II stars is that despite their lower overall metallicity, they often have a higher ratio of alpha elements (O, Si, Ne, etc.) relative to Fe as compared to Population I stars; current theory suggests this is the result of Type II supernovae being more important contributors to the interstellar medium at the time of their formation, whereas Type Ia supernova metal enrichment came later in the universe's evolution.

(Excerpt end)

Observation:

The theory the ISM “at the time of their formation” affects the metallicity is self-contradicting. Heavier elements present during formation would end up in the core by gravity. There is no mechanism for them to move from the core to the surface where they are found, by checking the spectrum from the surface.

The LMH solar model explains metallicity by transmutation on the photosphere, where the atoms are found. Metallicity has no direct relationship to age, as assumed.

8.4.3 Population I I I

Excerpt from Wikipedia:

Population III stars are a hypothetical population of extremely massive, luminous, and hot stars with virtually no metals, except possibly for intermixing ejecta from other nearby Population III supernovae. Such stars are likely to have existed in the very early universe (i.e., at high redshift), and may have started the production of chemical elements heavier than hydrogen that are needed for the later formation of planets and life as we know it.

The existence of Population III stars is inferred from physical cosmology, but they have not yet been observed directly. Indirect evidence for their existence has been found in a gravitationally lensed galaxy in a very distant part of the universe. Their existence may account for the fact that heavy elements – which could not have been created in the Big Bang – are observed in quasar emission spectra.

(Excerpt end)

Observation:

This description has important errors.

1) There is no such behavior as a gravitational lens. Neither gravity nor space-time can bend the path of light. Only diffraction can affect light because only a change in medium can affect its propagation. The fictitious lens is invoked wherever an object is observed in a position which is difficult to explain.

For more information about the mistake of a gravitational lens, consult my free pdf on that specific topic: Real Celestial Arcs Not From a Lens; its link can be found via References

For example, when a high-red shift object is near or adjacent to a low redshift object, a gravitational lens is claimed to bend the light so its measured position is an illusion. The correct explanation is the images are correct and the redshift measurements are the mistake, not the image.

A quasar has a completely different redshift mechanism than a galaxy. There is a separate section for quasars.

There is also a separate section for galaxy redshifts, using data from NED.

3) This third population is only hypothetical, based on the odd assumption that a star can form from only hydrogen, fuse it to only helium, and no other fusion can take place anywhere in or near this star, nor could it capture any atoms from the ISM simply by gravity.
It is pointless to propose a star remains in complete isolation for its entire lifetime. None have been “observed directly.”

Explaining the replacement of the defective fusion model by the LMH model is out of scope for this book. It is very important to note there are assumptions on the star types which lack a firm foundation.

There are various stellar behaviors which are not understood, like a supernova or metallicity, because the fundamental stellar model is wrong.

8.5 Neutron Star

This star consisting of only neutrons is impossible because neutrons outside of a atomic nucleus decay in less than 15 minutes into a proton and electron pair. There is no evidence that the compression of more neutrons can remain stable for a very long time.

A neutron star is sometimes called a pulsar, or short for pulsating star.
This star is an attempt to explain a rapid pulse period of synchrotron radiation. Like with black holes, cosmologists do not understand how a synchrotron works with the combination of an electric current changing its path by a magnetic field. The result is the relatively flat intensity of wavelength distribution from ultraviolet to radio, with the peak intensity wavelength driven by the velocity of the current. A synchrotron is capable of X-ray wavelengths.

Lacking knowledge of a synchrotron, cosmologist resort to a very simplistic lighthouse mechanism so the rate of rotation of a very compact source of radiation determines the time between pulses. These pulses can be separated by only milliseconds, requiring impossible rotation velocities.

The first synchrotron was built in 1945.
With knowledge of a synchrotron, the short pulse period of radiation is the result of a varying electric current source at that rate to the magnetic field which is generated by a separate electric current for the required magnetic field strength. This electrical solution avoids the impossible mechanical explanation.

There is no neutron star.

9 Black Hole

A black hole is the impossible consequence of extreme curvature encountered by the special moving observer. A black hole is needed in cosmology to explain X-ray sources when ignoring the known mechanism of generating X-rays from a synchrotron. By ignoring the obvious choice (the first synchrotron was built in 1945), cosmologists propose an accretion disk around a black hole. This disk must develop an impossible temperature to generate a thermal emission spectrum extending to X-ray wavelengths. The thermal radiation wavelength distribution is from ultraviolet to infrared, but the accretion disk must extend beyond the accepted range. Some claimed black holes generate to radio wavelengths. Thermal radiation extends to infrared wavelengths but not longer, like to radio.

9.1 M87 black hole image

In 2017, the Event Horizon Telescope project claimed to have an image of the black hole at the center of the M87 galaxy.

9.2 Plasmoid

Excerpt from Wikipedia:

A plasmoid is a coherent structure of plasma and magnetic fields. Plasmoids have been proposed to explain natural phenomena such as ball lightning, magnetic bubbles in the magnetosphere, and objects in cometary tails, in the solar wind, in the solar atmosphere, and in the heliospheric current sheet. Plasmoids produced in the laboratory include field-reversed configurations, spheromaks, and in dense plasma focuses.
The word plasmoid was coined in 1956 by Winston H. Bostick to mean a "plasma-magnetic entity":
The plasma is emitted not as an amorphous blob, but in the form of a torus. We shall take the liberty of calling this toroidal structure a plasmoid, a word which means plasma-magnetic entity. The word plasmoid will be employed as a generic term for all plasma-magnetic entities.

(Excerpt end)

Thunderbolts Project has a YouTube video clearly explaining a plasmoid.

A black hole is proposed for the M87 galaxy core as a source of X-rays.

This video explains a plasmoid and the object observed in M87, publicized in April 2019. Its title:

Thornhill: Black Hole or Plasmoid? | Space News

My observation:

The Event Horizon Telescope is not only one, but a dispersed array of radio telescopes. Their separate signals are processed by software to create a composite image. A proposed accretion disk radiates thermal radiation which cannot extend to radio wavelengths. The EHT when limited to radio cannot detect thermal radiation from an accretion disk. Only an electrical source can generate radio wavelengths, like a radio station's transmission antenna for its assigned frequency, or a source of synchrotron radiation.

There is no black hole.

10 Galaxy Types

The Data set containing galaxy data identifies the type for every galaxy.

10.1 Definition of the types

Wikipedia offers a detailed explanation of them.

Excerpt from Galaxy morphological classification:

Galaxy morphological classification is a system used by astronomers to divide galaxies into groups based on their visual appearance. There are several schemes in use by which galaxies can be classified according to their morphologies, the most famous being the Hubble sequence, devised by Edwin Hubble and later expanded by Gérard de Vaucouleurs and Allan Sandage. However, galaxy classification and morphology are now largely done using computational methods and physical morphology.

The de Vaucouleurs system retains Hubble's basic division of galaxies
into ellipticals, lenticulars, spirals and irregulars. To complement Hubble's scheme, de Vaucouleurs introduced a more elaborate classification system for spiral galaxies, based on three morphological characteristics:
Bars. Galaxies are divided on the basis of the presence or absence of a nuclear bar. De Vaucouleurs introduced the notation SA to denote spiral galaxies without bars, complementing Hubble's use of SB for barred spirals.

He also allowed for an intermediate class, denoted SAB, containing weakly barred spirals. Lenticular galaxies are also classified as unbarred (SA0) or barred (SB0), with the notation S0 reserved for those galaxies for which it is impossible to tell if a bar is present or not (usually because they are edge-on to the line-of-sight).

Rings. Galaxies are divided into those possessing ring-like structures (denoted ‘(r)’) and those without rings (denoted ‘(s)’). So-called ‘transition’ galaxies are given the symbol (rs).

Spiral arms. As in Hubble’s original scheme, spiral galaxies are assigned to a class based primarily on the tightness of their spiral arms. The de Vaucouleurs scheme extends the arms of Hubble’s tuning fork to include several additional spiral classes:

Sd (SBd) - diffuse, broken arms made up of individual stellar clusters and nebulae; very faint central bulge

Sm (SBm) - irregular in appearance; no bulge component

Im - highly irregular galaxy

Most galaxies in these three classes were classified as Irr I in Hubble’s original scheme. In addition, the Sd class contains some galaxies from Hubble’s Sc class. Galaxies in the classes Sm and Im are termed the “Magellanic” spirals and irregulars, respectively, after the Magellanic Clouds. The Large Magellanic Cloud is of type SBm, while the Small Magellanic Cloud is an irregular (Im).

The different elements of the classification scheme are combined — in the order in which they are listed — to give the complete classification of a galaxy. For example, a weakly barred spiral galaxy with loosely wound arms and a ring is denoted SAB(r)c.

Visually, the de Vaucouleurs system can be represented as a three-dimensional version of Hubble's tuning fork, with stage (spiralness) on the x-axis, family (barredness) on the y-axis, and variety (ringedness) on the z-axis.

(Excerpt end)

Observation:

This excerpt is not the complete topic but covers the important details. This is enough to understand most of the galaxies listed in the author's data set.

Note: AGN is sometimes found in descriptions of galaxies or quasars, AGN is short for Active Galactic Nucleus.

AGN refers to an active galactic nucleus generating intense radiation spanning a broad range of wave lengths from X-ray to radio. An AGN is a source of synchrotron radiation, a term explained in section Light.

Internal mechanisms in galaxies were covered in the author's earlier books and are not completely repeated here. This book is about measuring galaxies from on or near the Earth.

10.2 Seyfert Galaxy

A Seyfert galaxy is a special type of a spiral galaxy.

Excerpt from Wikipedia:

Seyfert galaxies are one of the two largest groups of active galaxies, along with quasars. They have quasar-like nuclei (very luminous, distant, and bright sources of electromagnetic radiation) with very high surface brightnesses whose spectra reveal strong, high-ionisation emission lines, but unlike quasars, their host galaxies are clearly detectable. Seyfert galaxies account for about 10% of all galaxies and are some of the most intensely studied objects in astronomy, as they are thought to be powered by the same phenomena that occur in quasars, although they are closer and less luminous than quasars.

(Excerpt end)

Observation:

This description reveals the lack of understanding the mechanisms driving the behaviors of a spiral galaxy. A spiral galaxy model defined by Donald Scott was described in an earlier book. A very brief summary is the spiral galaxy has an axial electrical current from its host cluster. This current generates the galactic magnetic field. The magnetic field generates the Lorentz force driving the disk rotation.

At the galactic core, the current bends and splits to provide a current out each spiral arm.

When an electric current changes its path due to a magnetic field, the result is synchrotron radiation. The velocity of the current drives the peak frequency in the synchrotron radiation distribution of energy. Nearly every spiral galaxy has its point source of X-rays in its core from this mechanism.

There is absolutely no dark matter. Any place this invisible, undetectable entity is proposed, there is a magnetic field being ignored.

10.3 Galaxy examples.

The following are spectrum samples from several Messier objects. These are all from NED, or the NASA Extragalactic Database.

That site offers a simple display where:
1) The object's name is entered into an entry field,

2) Click on Go,
3) Wait for the object to be found. Acceptable names can include an NGC number, or another name. For example, either M31 or NGC 224 gets the Andromeda galaxy.

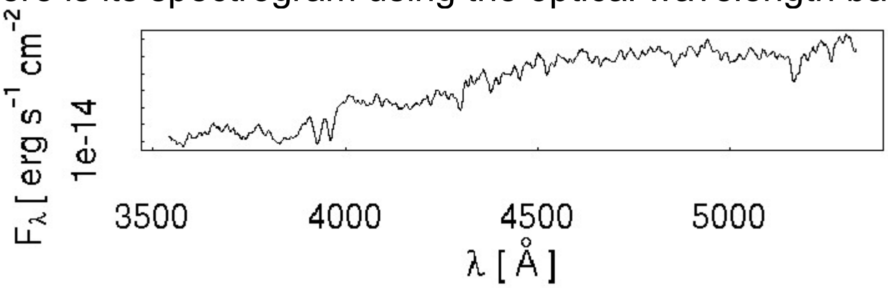
Some objects have more pages of data than others.

For this section, the Spectra selection shows the number of spectra recorded for the object. At the top right is the spectrum band, like Optical or Mid-IR, or UV, or even an emission line.
At the left of the NED page are images. Clicking on an image zooms in.

10.4 M31

M31 is a spiral galaxy in the Local Group.

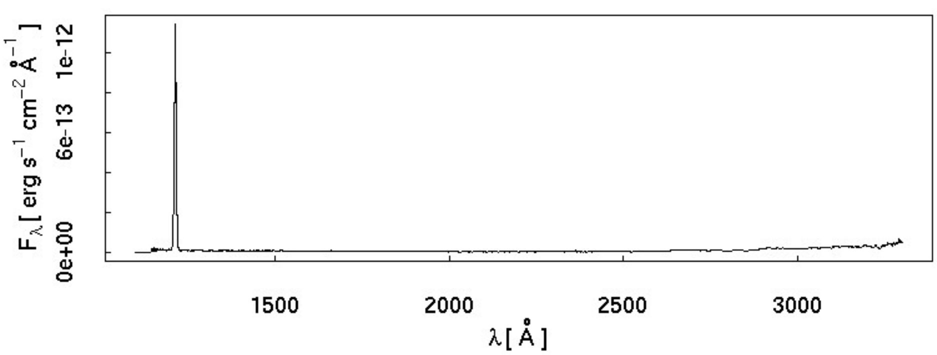
Here is its spectrogram using the optical wavelength band:



There are 2 dips below 4000 Angstroms. Those are the 2 absorption lines from calcium ions in the line of sight to M31.

The blue shift in those absorption lines is the justification of the M31 relative velocity of 401 km/s toward Earth. Atoms in the line of sight cannot be used to measure a large galaxy.

Here is its spectrogram in the ultraviolet wavelength band:

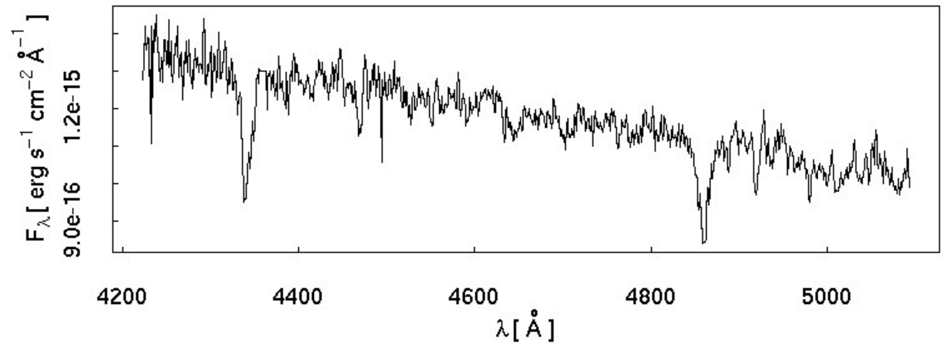


There is a strong emission line around 1215 Angstroms. That wavelength will be described below.

10.5 M33

M33 is a spiral galaxy in the Local Group.

Here is its spectrogram in the optical wave length band:

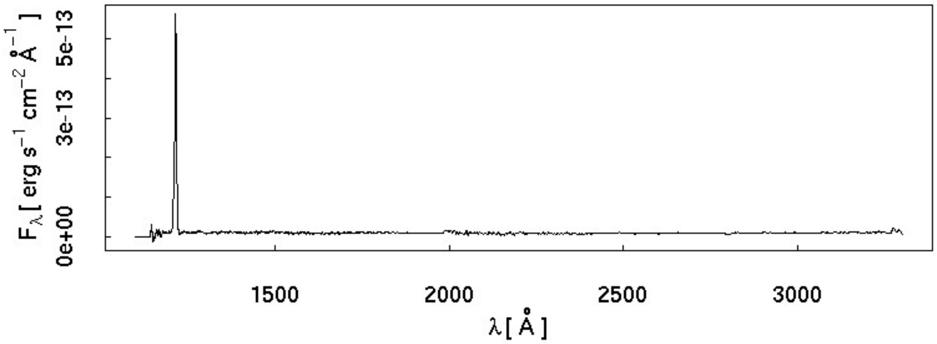


The spectrogram in NED for M33 has a slightly different span of wave lengths than for M31.

Both galaxies show the signature of synchrotron radiation with the range of wave lengths from ultraviolet to infrared having a similar intensity. Each dip is from atoms in the line of sight absorbing their characteristic wave lengths.

M33 has a number of absorption lines coming from atoms in the line of sight. They are the justification of the M33 relative velocity of 179 km/s toward Earth. Atoms in the line of sight cannot be used to measure a galaxy.

Here is the M33 spectrogram in the ultraviolet wave length band:



Just like with M31, there is a strong emission line near 1216 Angstroms.

10.6 Lyman Alpha Emitter Galaxy

Excerpt from Wikipedia:

A Lyman-alpha emitter (LAE) is a type of distant galaxy that emits Lyman-alpha radiation from neutral hydrogen.
Most known LAEs are extremely distant, and because of the finite travel time of light they provide glimpses into the history of the universe. They are thought to be the progenitors of most modern Milky Way type galaxies.

The baryonic acoustic oscillation signal should be evident in the power spectrum of Lyman-alpha emitters at high redshift. Baryonic acoustic oscillations are imprints of sound waves on scales where radiation pressure stabilized the density perturbations against gravitational collapse in the early universe. The three-dimensional distribution of the characteristically homogeneous Lyman-alpha galaxy population will allow a robust probe of cosmology.

They are a good tool because the Lyman-alpha bias, the propensity for galaxies to form in the highest overdensity of the underlying dark matter distribution, can be modeled and accounted for. Lyman-alpha emitters are over dense in clusters.

(Excerpt end)

This description reveals much confusion. First, the Lyman-alpha emission line occurs a proton captures an electron, and the electron drops to the hydrogen ground state.

References to “baryonic acoustic oscillation” are meaningless. Attempts to model “dark matter distribution” are meaningless. There is no dark matter. That mistake was covered in previous books.

The description implies no recognition that both M31 and M33 are Lyman-alpha emitters. These 2 galaxies are very close, even within our Local Group. They directly contradict the claim the LAE type is found only at great distance.

This Lyman-alpha emission occurs from an event in the line of sight to a galaxy. That event is a proton capturing an electron. This event cannot be related to the galaxy. Trying to link an electron capture by a proton to the age of the galaxy is unjustified and ridiculous.

10 Quasar

Quasar is short for quasi-stellar object. They are faint in visual wave lengths, by dimming from clouds of ions, but intense in a wide range of wavelength from X-ray to radio.
A quasar is misunderstood in modern cosmology, because like a black hole it is a source of synchrotron radiation. Cosmology generally avoids electromagnetic behaviors

This book is mostly about galaxies but quasars are important because quasars are always redshifted and often observed in association with a galaxy. Halton Arp presented, in his book Seeing Red, his conclusion quasars are ejected from a Seyfert galaxy along the galaxy's axis. Often a pair was ejected in opposite directions. Arp noted that with increasing distance from its Seyfert, the quasar red shift seemed to reduce in similar increments, what he called a quantized red shift.

The spectrum of a quasar has many emission lines. Arp did not do an analysis of a quasar's redshift mechanism, but I did. His book offered 2 annotated spectrograms.
A quasar actually has 2 measurable red shifts:

1) Hydrogen Lyman-alpha emission line; this occurs when a proton captures an electron; the change in the new hydrogen atom's energy state is radiated away in this wavelength; the kinetic energy of the proton at that instant results in a red shift of that wave length.
This emission line is found in a typical quasar and is its primary red shift measurement. There are quasars with this line red shifted indicating a proton velocity more than 6 times the velocity of light, when the quasar z is greater than 6.

This proton has a high velocity and is approaching the quasar from an unknown source, though it is certainly not local given its velocity is different than that of the second red shift.

2) Emission lines from a number of metallic ions, where metallic means not hydrogen or helium.

These emission lines occur when an ion captures an electron; the change in the ion's energy state is radiated away in this wavelength; the ion's velocity, relative to the velocity of light at that instant, results in a red shift of that characteristic wavelength. All the ions share the same red shift because all are moving by the electrical charge differential with the plasmoid in the quasar's core.

The variety of metallic ions can vary among quasars from different Seyferts.

A Seyfert galaxy is in a galaxy class called LINER, for
Low-Ionization Nuclear Emission Region.

When a Seyfert ejects a plasmoid from its core, the plasmoid is accompanied by the mix of metal ions in this particular Seyfert.

The Seyfert provides the ions which are observed by the second red shift

A plasmoid is a torus-shaped plasma entity having an electrical current bound by its magnetic field. A plasmoid was famously imaged in April 2019 in the core of M87 galaxy.

Black holes do not exist, and both the singularity and a theoretical accretion disk emitting X-rays are physically impossible.

Black holes have their own section. A plasmoid is explained there.
A Caltech web article describing a typical quasar spectrum included its spectrogram. Here it is, including its caption.

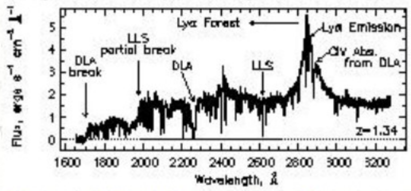


Figure 1. Typical spectrum of a quasar, showing the quasar continuum and emission lines, and the absorption lines produced by galaxies and intergalactic material that lie between the quasar and the observer. This spectrum of the z = 1.34 quasar PKS0454+039 was obtained with the Faint Object Spectrograph on the Hubble Space Telescope. The emission lines at ~ 2400 Å and ~ 2850 Å are Lyβ and Lyα. The Lyα forest, absorption produced by various intergalactic clouds, is apparent at wavelengths blueward of the Lyα emission line. The two strongest absorbers, due to galaxies, are a damped Lyα absorber at z = 0.86 and a Lyman limit system at z = 1.15. The former produces a Lyman limit break at ~ 1700 Å and the latter a partial Lyman limit break at ~ 1950 Å since the neutral Hydrogen column density is not large enough for it to absorb all ionizing photons. Many absorption lines are produced by the DLA at z = 0.86 (C IV λλ1548, for example, is redshifted onto the red wing of the quasar's Lyα emission line).

One of the important references is “the neutral hydrogen column density.” This density affects the shift in the neutral hydrogen emission line at 21 cm. This line shift occurs in the “intergalactic material between the quasar and the observer.”

Those in this study know the neutral hydrogen line is from those atoms in the intergalactic medium and any shift in the line is not caused by the quasar. The same applies to a galaxy, in place of a quasar as the distant light source.

The caption finishes with the “quasar’s Lya emission line.

The Lyman-alpha emitter galaxy description implied this line occurs under extreme conditions, while a typical quasar will exhibit this emission line.

The comparison suggests the LAE galaxy description was written when unaware of typical quasars.

The very important conclusion with quasars is their red shift always comes from emission lines, which always come from an ion or proton capturing an electron. Emission lines offer no information, like velocity, of any object behind them in the line of sight.

11 Dark Matter

11.1 Definition of dark matter

Excerpt from Wikipedia:

Dark matter is a form of matter thought to account for approximately 85% of the matter in the universe and about a quarter of its total energy density. Its presence is implied in a variety of astrophysical observations, including gravitational effects that cannot be explained by accepted theories of gravity unless more matter is present than can be seen. For this reason, most experts think that dark matter is abundant in the universe and that it has had a strong influence on its structure and evolution. Dark matter is called dark because it does not appear to interact with observable electromagnetic radiation, such as light, and so it is undetectable by existing astronomical instruments.

(Excerpt end)

Observation:

Dark matter is undefined but is found only where a behavior cannot be explained "unless more matter is present than can be seen."
Given that simple criteria for a required explanation, there are 2 simple alternatives:
1) More unseen matter is needed. Or,
2) An unseen force other than gravity is involved.

Cosmologists have simply neglected pursuing (2).

The solution in (2) will be pursued below.

c) Observed need for dark matter

There is an anomaly in a spiral galaxy rotation.

Continue excerpt from Wikipedia:

Early mapping of Andromeda with the 300 foot telescope at Green Bank and the 250 foot dish at Jodrell Bank already showed the H-I rotation curve did not trace the expected Keplerian decline. As more sensitive receivers became available, Morton Roberts and Robert Whitehurst were able to trace the rotational velocity of Andromeda to 30 kpc, much beyond the optical measurements.

The primary claim for dark matter is it explains the unexpected velocities observed in a spiral galaxy rotation.

(Excerpt end)

Observation:

The 'expected keplerian decline' is a mistake because the expectation is stellar motion is like planets in our solar system.

Excerpt of interview with Vera Rubin in a 2006 story titled “Seeing dark matter in the Andromeda galaxy” in Physics Today:

Our 1970 paper included optical observations out to 120 arcmin but did not include the superposed image of M31, or the 1975 radio observations shown in the figure. This composite of the galaxy and velocities emphasizes the extent of the optical image and the “flatness” of the velocities. We found it puzzling that stars far from the center traveled as fast as those much closer to the center. However, we chose not to extend the curve beyond the final measurement by using a decreasing Newtonian inverse square velocity, the common practice at that time. Instead, we wrote “extrapolation beyond that point is clearly a matter of taste.”

Isaac Newton showed that the force on a mass at radius r from the center of a symmetrical mass distribution is proportional to the mass interior to that r. High-school students learn that in a gravitationally bound system like our solar system, a planet moves in a closed orbit, such that MG = V^2 * r where M is the mass of the Sun, G is the gravitational constant, and V and r are the velocity of a planet and its distance from the Sun. In M31, the same relation between mass, velocity, and distance holds. A flat rotation curve (V = constant) implies that mass increases linearly with distance from the center. Enormous amounts of nonluminous matter extend far beyond the optical image of M31.

(Excerpt end)

Observation:

High-school students learn of planet orbits but perhaps they should learn the barycenter (the center of gravity) is critical, to avoid the serious mistake of assuming simple 'keplerian' orbits around the Sun is correct for a galaxy.

Our solar system has less than a dozen large bodies involved with this barycenter.

A galaxy like M31 has billions of stars in its disk.

This is a mistake to assume billions of stars distributed within distinct arms in the disk move about a galactic barycenter just like the 8 planets in simple ellipses in a limited system of the Sun and 8 planets.

11.2 Search for Dark Matter

Excerpt from CERN:

Many theories say the dark matter particles would be light enough to be produced at the LHC. If they were created at the LHC, they would escape through the detectors unnoticed. However, they would carry away energy and momentum, so physicists could infer their existence from the amount of energy and momentum “missing” after a collision. Dark matter candidates arise frequently in theories that suggest physics beyond the Standard Model, such as supersymmetry and extra dimensions. One theory suggests the existence of a “Hidden Valley”, a parallel world made of dark matter having very little in common with matter we know. If one of these theories proved to be true, it could help scientists gain a better understanding of the composition of our universe and, in particular, how galaxies hold together.
(Excerpt end)

Observation:

References to "beyond the Standard Model" or "extra dimensions" or "parallel world" demonstrate this search is just conjecture (or science fiction fantasy). The definition must be something based in classical physics where evidence by experiment is required.

11.3 Alternative to dark matter found in 2010

Cosmologists had a choice in 2010 when scientists observed the M31 rotation curve could be explained by the galactic magnetic field meaning the stars were not moving like planets driven only by gravity around the solar system barycenter.

From “Magnetic Fields and the Outer Rotation Curve of 31" the 2010 paper from Astrophysical Journal Letters.

Excerpt:

Observations of the rotation curve of M31 show a rise of the outer part that can not be understood in terms of standard dark matter models or perturbations of the galactic disc by M31's satellites. Here, we propose an explanation of this dynamical feature based on the influence of the magnetic field within the thin disc. We have considered standard mass models for the luminous mass distribution, a NFW model to describe the dark halo, and we have added up the contribution to the rotation curve of a magnetic field in the disc, which is described by an axisymmetric pattern. Our conclusion is that a significant improvement of the fit in the outer part is obtained when magnetic effects are considered. The best-fit solution requires amplitude of [about] 4 microG with a weak radial dependence between 10 and 38 kpc.

(Excerpt end)

Observation:

The rotation curve cannot be explained using dark matter. The best fit is obtained using the galactic magnetic field.

Upon the M31 study's finding, cosmologists could abandon the barycenter assumption and replace it with the magnetic field.

A YouTube video of the paper's presentation can be found by the paper's title: "Magnetic Fields and the Outer Rotation Curve of M31"

Upon the M31 study's conclusion, cosmologists could abandon the barycenter assumption and replace it with the galactic magnetic field.

11.4 Similar alternative to dark matter explained in 2018

A paper in 2018 concluded the galactic magnetic field drives the galactic rotation and no undetectable dark matter is required.

The paper is titled "Birkeland Currents and Dark Matter" and can be found with a web search.

Excerpt from its conclusion:

An observation that is “anomalous” is one that is inconsistent with accepted hypotheses. In real science this requires the replacement of the falsified hypothesis, not an eighty-five year hunt for invisible entities that will preserve it. The work being presented here demonstrates that the root cause of the now vast collection of observed “anomalous” galactic stellar rotation profiles is the electrical nature of the Birkeland Currents on which those galaxies have been or are being formed.

11.5 Alternative to dark matter found in 2015

An important conclusion after a study of IC342, a large obscured, nearby spiral galaxy:

Excerpt from the story titled:” Magnetic fields in spiral galaxy arms”

"Spiral arms can hardly be formed by gravitational forces alone," continues Rainer Beck. "This new IC 342 image indicates that magnetic fields also play an important role in forming spiral arms."

(Excerpt end)

Wherever there is a claimed need for dark matter, there is a magnetic field being ignored.

There is no dark matter.

12 Data Sets

The author compiled data into a large data set to support this book's conclusions. To make sure this analysis was not skewed by a single source, two were used.

12.1 Caveat

There was a crucial limitation in analyzing the public values for each galaxy in the author's first book. Wikipedia rarely identifies when a Cepheid was used for a galaxy distance. By using a second source, this deficiency was addressed by using a second source, which provided the detail, deep in its multiple pages for each galaxy
The author uses 2 references: Wikipedia or NASA/IPAC Extragalactic Database. This reference site will be NED in this book. Unfortunately, the 2 references do not agree in all galaxies.

Though there are many galaxies having an assigned number, only those galaxies having defined celestial coordinates are listed. The galaxies are entered by increasing right ascension values in each constellation.

Those galaxies having no velocity and distance values are sometimes omitted as they offer nothing to the analysis. Some were entered, though lacking those values, when their presence in the cluster's data contributes to the analysis of angular separation between consecutive galaxies within a cluster.

Galaxies are in order of quadrant, then increasing RA through each of the constellations in the quadrant.

12.2 Wikipedia Layout

Wikipedia has a general format for a galaxy's data. At the top of the page is general information. Sometimes, the data of interest, like distance, could be found here. Sometimes the value will match or disagree with its later value.

Some galaxies will have an image to the right of the description.
The right side of the page will have the galaxy's celestial coordinates, at the top, or below the image.

Each galaxy will have Redshift data, as one or more velocities.

Many will have one or both of a z value or a km/s value. The km/s value must match z multiplied by 3E5 or one or both is a mistake.

There can be a helio radial velocity; this is the one to use. NED also uses this term.
There can be a galactocentric velocity; this value is not for this analysis; so ignore it.

Below the velocities, there is usually a Distance. It will be stated in Mly, or Mpc or both.

Next, there should be the visual magnitude, as Apparent magnitude (V). This is the value of interest. There could be others, such as Absolute (A) or bolometric (B), but they are not used in this analysis.

Next are the galaxy Characteristics.

These include the Type. This is used for every galaxy.

Some pages will have its size, stated as either a linear dimension in lightyears or parsecs or as one or more angular dimensions, usually in moa, or minutes of arc, or arc-minutes. Sometimes arc-seconds are used.

Some galaxies offer more data, such as an estimated mass, or star count but none of these are used. They are probably based on assumptions after calculating a distance. These values cannot be measured directly.

12.3 NED Layout of galaxy data

The NASA/IPAC Extragalactic Database (NED) is funded by the National Aeronautics and Space Administration and operated by the California Institute of Technology.
NED has a general format for a galaxy's data. At the top of the page is a series of tabs. Each title is followed by a number inside (), where the number indicates the number of items available after this selection.

The relevant tabs are:

- Redshifts
- Spectra
- Distances

Redshifts should include the number of lines indicated, but only 2 are used:
V (heliocentric) followed by the value in km/s.

D (Local Group) followed by a value in Mpc.

The Wikipedia velocity value should match NED, depending on whether:

a) the sites are synchronized, or

b) Wikpedia is showing a velocity coming from another value in NED, such a velocity assumed to come from a distance calculation. NED might make the mistake of applying Hubble's Law when it cannot apply.

The Wikipedia distance value should match the value in NED, depending on whether:

a) the data in the two sites are synchronized, or

b) Wikipedia is showing a distance from another value in NED, such from a distance calculation based on a mechanism other than redshift, such as Cepheids.

Wikipedia never identifies the mechanism providing a galaxy's velocity or distance.

The Spectra selection should show the number of spectra indicated by ().

Unfortunately, NED never explicitly identifies which specific spectrum was used for the stated redshift value in that tab's line.

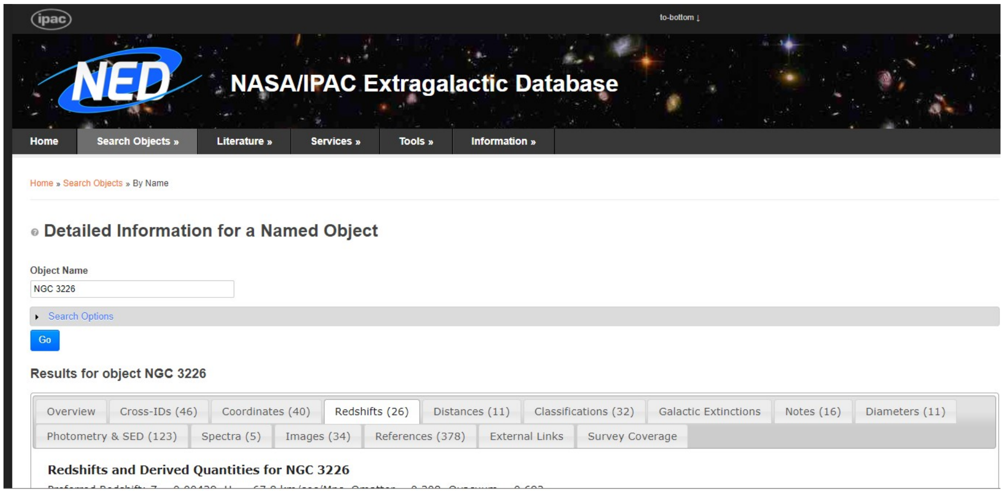
12.4 NED Example with NGC 3226

An example might make the descriptions clearer because it has data available for its tabs.

Here is a sequence of screen captures. Links to the original images are available through the file in References.

12.4.1 Image 1

NGC 3226 is entered in the box and the Go button is selected.



There is usually a delay between Go and the display of: Results for object, with the bar having the tab selections.

12.4.2 Image 2

Selecting the Redshifts tab shows its data. The legend indicates 26 lines for this galaxy.

Redshifts and Derived Quantities for NGC 3226

Preferred Redshift: Z = 0.00439, H_0 = 67.8 km/sec/Mpc, Ωmatter = 0.308, Ωvacuum = 0.692

Quantities Derived from Preferred Redshift for NGC 3226

Calculated and Corrected Velocities

Type	Velocities	Reference (View References in ADS)
V (Heliocentric)	1315 ± 5 km/s	2011MNRAS.413..813C
V (Kinematic LSR)	1312 ± 5 km/s	1986MNRAS.221.1023K
V (Galactocentric GSR)	1237 ± 6 km/s	1991RC3.9.C...0000d
V (Local Group)	1197 ± 9 km/s	1996AJ....111..794K
V (3K CMB)	1638 ± 23 km/s	1996ApJ...473..576F
V (Virgo Infall only)	1552 ± 26 km/s	2000ApJ...529..786M
V (Virgo + GA only)	1696 ± 28 km/s	2000ApJ...529..786M
V (Virgo + GA + Shapley)	1705 ± 28 km/s	2000ApJ...529..786M

Hubble Flow Distance and Distance Modulus (where H_0 = 67.8 km/sec/Mpc ± km/sec/Mpc)

Type	Distance	Modulus
D (Galactocentric GSR)	18.25 ± 1.28 Mpc	(m-M) = 31.31 ± 0.15 mag
D (Local Group)	17.65 ± 1.24 Mpc	(m-M) = 31.23 ± 0.15 mag
D (3K CMB)	24.16 ± 1.73 Mpc	(m-M) = 31.92 ± 0.15 mag
D (Virgo Infall only)	22.90 ± 1.65 Mpc	(m-M) = 31.80 ± 0.15 mag
D (Virgo + GA only)	25.02 ± 1.76 Mpc	(m-M) = 31.99 ± 0.15 mag
D (Virgo + GA + Shapley)	25.15 ± 1.76 Mpc	(m-M) = 32.00 ± 0.15 mag

Scale at Hubble Flow Distances

Type	Values
Scale (Galactocentric GSR)	88 pc/arcsec = 0.088 kpc/arcsec = 5.31 kpc/arcmin = 0.32 Mpc/degree

.

12.4.3 Image 3

The display is longer than this page. Here is more:

Scale at Hubble Flow Distances	
Type	Values
Scale (Galactocentric GSR)	88 pc/arcsec = 0.088 kpc/arcsec = 5.31 kpc/arcmin = 0.32 Mpc/degree
Scale (Local Group)	86 pc/arcsec = 0.086 kpc/arcsec = 5.14 kpc/arcmin = 0.31 Mpc/degree
Scale (3K CMB)	117 pc/arcsec = 0.117 kpc/arcsec = 7.03 kpc/arcmin = 0.42 Mpc/degree
Scale (Virgo Infall only)	111 pc/arcsec = 0.111 kpc/arcsec = 6.66 kpc/arcmin = 0.40 Mpc/degree
Scale (Virgo + GA only)	121 pc/arcsec = 0.121 kpc/arcsec = 7.28 kpc/arcmin = 0.44 Mpc/degree
Scale (Virgo + GA + Shapley)	122 pc/arcsec = 0.122 kpc/arcsec = 7.32 kpc/arcmin = 0.44 Mpc/degree
Cosmology-Corrected Quantities [H_0 = 67.8 km/sec/Mpc, Ω_{matter} = 0.308, Ω_{vacuum} = 0.692]	
[Redshift 0.005464 as corrected to the Reference Frame defined by the 3K CMB]	
Type	Values
Luminosity Distance	24.3 Mpc (m-M) = 31.92 mag
Angular-Size Distance	24 (m-M) = 31.90 mag
Co-Moving Radial Distance	24.1 (m-M) = 31.91 mag
Co-Moving Tangential Distance	24.1 (m-M) = 31.91 mag
Co-Moving Volume	5.88e-05 Gpc^3
Light Travel-Time	0.078 Gyr
Age at Redshift 0.005464	13.726 Gyr
Age of Universe	13.804 Gyr
Scale (Cosmology Corrected)	116 pc/arcsec = 0.116 kpc/arcsec = 6.98 kpc/arcmin = 0.42 Mpc/degree
Surface Brightness Dimming	Flux Density per Unit Area = 0.97844; Magnitude per Unit Area = 0.02366 mag

Measured Redshifts of NGC 3226

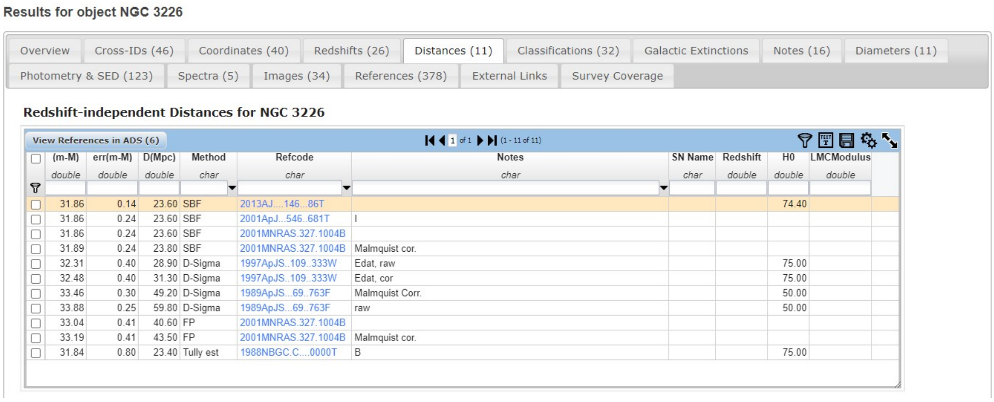
See also Distances.

Here is part of image 3, but slightly larger.

Cosmology-Corrected Quantities [H_0 = 67.8 km/sec/Mpc, Ω_{matter} = 0.308, Ω_{vacuum} = 0.692]	
[Redshift 0.005464 as corrected to the Reference Frame defined by the 3K CMB]	
Type	Values
Luminosity Distance	24.3 Mpc (m-M) = 31.92 mag
Angular-Size Distance	24 (m-M) = 31.90 mag
Co-Moving Radial Distance	24.1 (m-M) = 31.91 mag
Co-Moving Tangential Distance	24.1 (m-M) = 31.91 mag
Co-Moving Volume	5.88e-05 Gpc^3
Light Travel-Time	0.078 Gyr
Age at Redshift 0.005464	13.726 Gyr
Age of Universe	13.804 Gyr
Scale (Cosmology Corrected)	116 pc/arcsec = 0.116 kpc/arcsec = 6.98 kpc/arcmin = 0.42 Mpc/degree
Surface Brightness Dimming	Flux Density per Unit Area = 0.97844; Magnitude per Unit Area = 0.02366 mag

12.4.4 Image 4

Selecting the Distances tab shows its data. The legend indicates 11 lines for this galaxy.



Results for object NGC 3226

Overview | Cross-IDs (46) | Coordinates (40) | Redshifts (26) | Distances (11) | Classifications (32) | Galactic Extinctions | Notes (16) | Diameters (11) | Photometry & SED (123) | Spectra (5) | Images (34) | References (378) | External Links | Survey Coverage

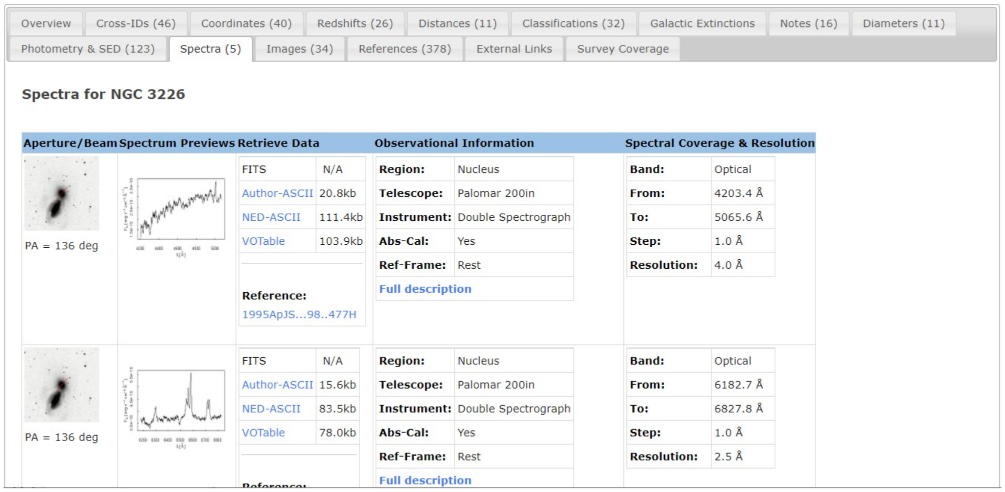
Redshift-independent Distances for NGC 3226

View References in ADS (6) 1 of 1 (1 - 11 of 11)

(m-M) double	err(m-M) double	D(Mpc) double	Method char	Refcode char	Notes char	SN Name char	Redshift double	H0 double	LMCModulus double
31.86	0.14	23.60	SBF	2013AJ....146...86T				74.40	
31.86	0.24	23.60	SBF	2001ApJ...546..681T	I				
31.86	0.24	23.60	SBF	2001MNRAS.327.1004B					
31.89	0.24	23.80	SBF	2001MNRAS.327.1004B	Malmquist cor.				
32.31	0.40	28.90	D-Sigma	1997ApJS..109..333W	Edat, raw			75.00	
32.48	0.40	31.30	D-Sigma	1997ApJS..109..333W	Edat, cor			75.00	
33.46	0.30	49.20	D-Sigma	1989ApJS...69..763F	Malmquist Corr.			50.00	
33.88	0.25	59.80	D-Sigma	1989ApJS...69..763F	raw			50.00	
33.04	0.41	40.60	FP	2001MNRAS.327.1004B					
33.19	0.41	43.50	FP	2001MNRAS.327.1004B	Malmquist cor.				
31.84	0.80	23.40	Tully est	1988NBGC.C....0000T	B			75.00	

12.4.5 Image 5

Selecting the Spectra tab shows its data. The legend indicates 5 items for this galaxy.

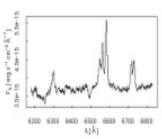


Overview | Cross-IDs (46) | Coordinates (40) | Redshifts (26) | Distances (11) | Classifications (32) | Galactic Extinctions | Notes (16) | Diameters (11)
Photometry & SED (123) | Spectra (5) | Images (34) | References (378) | External Links | Survey Coverage

Spectra for NGC 3226

Aperture/Beam	Spectrum Previews	Retrieve Data	Observational Information	Spectral Coverage & Resolution
PA = 136 deg		FITS N/A Author-ASCII 20.8kb NED-ASCII 111.4kb VOTable 103.9kb **Reference:** 1995ApJS...98..477H	**Region:** Nucleus **Telescope:** Palomar 200in **Instrument:** Double Spectrograph **Abs-Cal:** Yes **Ref-Frame:** Rest **Full description**	**Band:** Optical **From:** 4203.4 Å **To:** 5065.6 Å **Step:** 1.0 Å **Resolution:** 4.0 Å
PA = 136 deg		FITS N/A Author-ASCII 15.6kb NED-ASCII 83.5kb VOTable 78.0kb **Reference:**	**Region:** Nucleus **Telescope:** Palomar 200in **Instrument:** Double Spectrograph **Abs-Cal:** Yes **Ref-Frame:** Rest **Full description**	**Band:** Optical **From:** 6182.7 Å **To:** 6827.8 Å **Step:** 1.0 Å **Resolution:** 2.5 Å

12.4.6 Image 6
The display is longer than this page. Here is more of the display (second Optical with others below it):



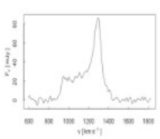
FITS	N/A
Author-ASCII	15.6kb
NED-ASCII	83.5kb
VOTable	78.0kb

Reference:
1995ApJS...98..477H

Region:	Nucleus
Telescope:	Palomar 200in
Instrument:	Double Spectrograph
Abs-Cal:	Yes
Ref-Frame:	Rest

Full description

Band:	Optical
From:	6182.7 Å
To:	6827.8 Å
Step:	1.0 Å
Resolution:	2.5 Å



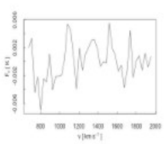
FITS	N/A
Author-ASCII	14.8kb
NED-ASCII	51.2kb
VOTable	48.1kb

Reference:
2001A&A...378..370V

Region:	Integrated
Telescope:	Nancay
Instrument:	Auto-Correlator Spectrometer
Abs-Cal:	Yes
Ref-Frame:	Observed

Full description

Line:	H I
From:	596.1 km s^{-1}
To:	1823.3 km s^{-1}
Step:	3.1 km s^{-1}
Resolution:	7.9 km s^{-1}



FITS	N/A
Author-ASCII	1.6kb
NED-ASCII	3.1kb
VOTable	N/A

Reference:

Region:	Integrated
Telescope:	IRAM 30m
Instrument:	SIS
Abs-Cal:	Yes
Ref-Frame:	Observed

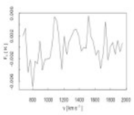
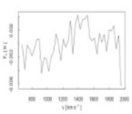
Full description

Line:	CO (1-0)
From:	675.6 km s^{-1}
To:	1955.2 km s^{-1}
Step:	31.2 km s^{-1}
Resolution:	5.0 km s^{-1}

There is a second CO line spectrum.

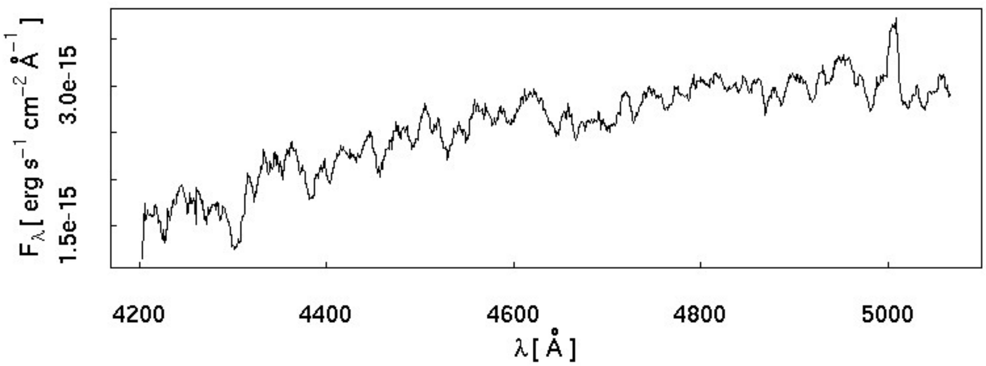
12.4.7 Image 7

The display is longer than this page. Here is more:

 PA = N/A		FITS N/A Author-ASCII 1.6kb NED-ASCII 3.1kb VOTable N/A **Reference:** 2011MNRAS.414..940Y	**Region:** Integrated **Telescope:** IRAM 30m **Instrument:** SIS **Abs-Cal:** Yes **Ref-Frame:** Observed **Full description**	**Line:** CO (1-0) **From:** 675.6 km s^{-1} **To:** 1955.2 km s^{-1} **Step:** 31.2 km s^{-1} **Resolution:** 5.0 km s^{-1}
 PA = N/A		FITS N/A Author-ASCII 1.6kb NED-ASCII 3.1kb VOTable N/A **Reference:** 2011MNRAS.414..940Y	**Region:** Integrated **Telescope:** IRAM 30m **Instrument:** SIS **Abs-Cal:** Yes **Ref-Frame:** Observed **Full description**	**Line:** CO (2-1) **From:** 675.6 km s^{-1} **To:** 1955.2 km s^{-1} **Step:** 31.2 km s^{-1} **Resolution:** 5.0 km s^{-1}

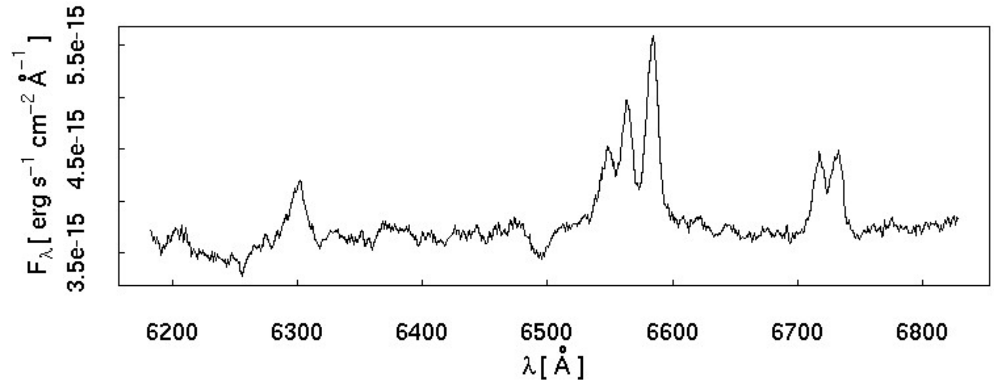
12.4.8 Image 8

There are 5 spectra for this galaxy. Here is only the first, making it clearer on this page. This is Optical from the Nucleus region, using the Palomar 200m Telescope and its Double Spectrograph Instrument.



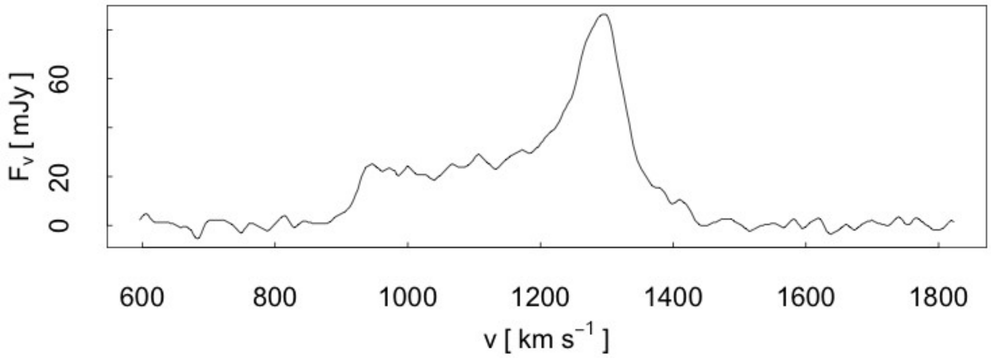
There is a metallic absorption line around 4300 A and a metallic emission line around 5000 A.

12.4.9 Image 9
Here is only the second spectrum of the 5.
This is Optical from the Nucleus region, using the Palomar 200m Telescope and its Double Spectrograph Instrument.



There are metallic emission lines around 6300 A, 6570, and a pair around 6750 A.

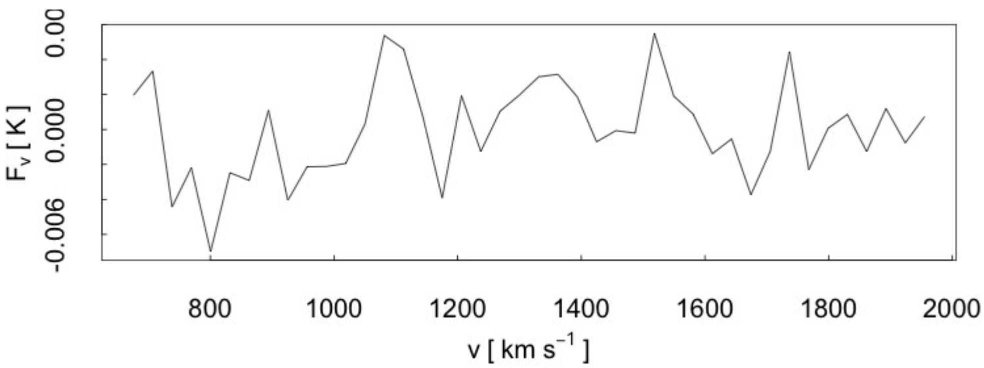
12.4.10 Image 10
Here is only the third spectrum of the 5. This is the H I line from the Integrated Region using the Nancay Telescope and its Auto Correlator Spectrometer Instrument.



This is not a spectrum. Whatever spectrum was recorded, only a distribution of velocities is presented. This image offers no information of what was actually measured.

12.4.11 Image 11

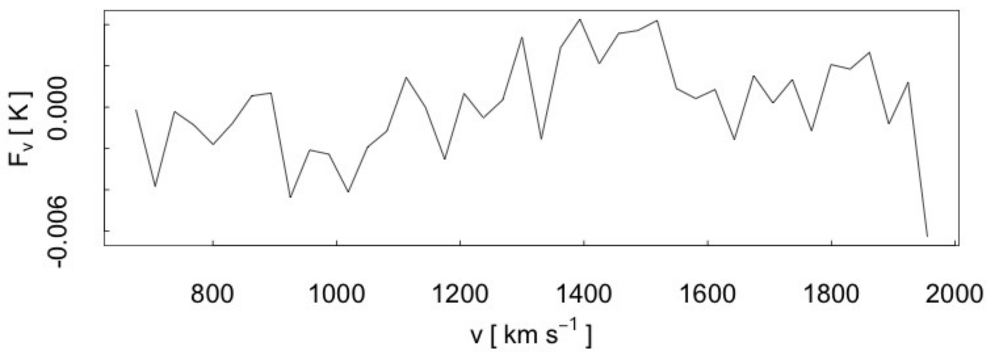
Here is only the fourth spectrum of the 5. This is the CO (1-0) line from the Integrated region using the IRAM Telescope and its ISIS Instrument.



This is not a spectrum. Whatever spectrum was recorded, only a distribution of velocities is presented. This image offers no information of what was actually measured.

12.4.12 Image 12

Here is only the last spectrum of the 5. This is the CO (2-1) line from the Integrated region using the IRAM Telescope and its ISIS Instrument.



This is not a spectrum. Whatever spectrum was recorded, only a distribution of velocities is presented. This image offers no information of what was actually measured.

12.4.13 NGC 3226 Data observations

There are several important observations with only one galaxy, which is serving as an example.

1) The redshift velocity value does not identify its origin. It is probably from one of the emission lines. This galaxy has several candidates in the first 2 spectra for a selection.

This is negligence, providing a value with nothing to support it.

2) The neutral hydrogen line measurement is not provided. Instead only a velocity is charted with a distribution of intensity across a range of velocities.

If such a measurement is being used as the galaxy redshift velocity, despite there being no value of a measured change in a wavelength, it requires explicit definition of its uncertainty and margin of error. This not a bell curve suggesting probabilities, but is closer to a random distribution of possible values

2) The CO line measurements have no basis. Instead, only a velocity is charted with a distribution of intensity across a range of velocities.

The author finds nothing in the NED site or in Wikipedia explaining a CO line.

There are 2 measurements of CO line but they have different distributions, while having the same range on the X-axis.

Whatever this CO line is, it must be ignored because it is physically impossible to measure the 3-dimensional velocity of a galaxy using a line of sight observation. To measure the proper velocity of a planet, many observations over a period of time are required. The same requirement applies to a galaxy.

3) Using CMB

There is a very alarming line on the Redshifts page:

[Redshift 0.005464 as corrected to the Reference Frame defined by the 3K CMB]

There is no Cosmic Microwave Background, so any “correction” is actually a “corruption” so the data must have the correction removed. Now the data must be treated as having an error present in its values.

When a velocity is multiplied by Hubble’s constant to calculate a distance then the distance calculation spreads this error.

Dr. Pierre-Marie Robitaille has extensively explained the many errors in the multiple claimed measurements of the CMB.

He has many posted a number of videos in his Sky Scholar channel on YouTube, but the relevant one is titled “The Herouni Antenna - The Death of the Big Bang!”

A properly designed radio telescope in Armenia measured no CMB.

12.5 Data Archive Layout

The data for each galaxy includes the following.
The worksheet column's letter is at the start of the line, before its header and brief description:

A) Name; usually NGC number
B) Other name; Like Messier number or Arp number
C) Other names, like Whirlpool

D) Galaxy type, like SAB(s)ab; always copied from Wikipedia.

E) Gen type, like E, I, L, S, or SB; this used for a simple distribution of types. This is the author's entry.

F) Parent, like its cluster
G) Constellation
H) Quadrant, sorted from NQ1 to SQ4

I) Right Ascension, entered as hms
J) Declination, entered as dms
K) RA-Degrees; normally hidden; author's macro converts column I text to numeric value in units of degrees (15 degrees/hr)
L) Dec-Degrees; normally hidden; author's macro converts column J text to numeric value in units of degrees
M) Comment, like a notable feature (e.g., bridge or jet)
N) LINER identifies this class of galaxy
O) Magnitude
P) Angle, where 0= face-on, 90= edge-on
Q) Size in Kly
R) size 1, in moa or arc-minutes
S) size 2, in moa or arc-minutes
T) Velocity as km/s
U) Distance in Mly
V) Distance in Mpc
W) calculate h
X) blank
Y) NED - >, columns to right have data from NED
Z) NED Velocity in km/s from redshift
AA) NED H0 value
AB) NED Distance in Mpc from redshift
AC) NED Distance in Mly
AD) calculate h for NED
AE) X-ray range in set of spectra
AF) UV range in set
AG) Optical range in set
AH) Near-IR range in set
AI) Mid-IR range in set
AJ) Far-IR range in set
AK) no range in set
AL) Ly-a absorption in UV spectrum
AM) Ly-a emission in UV spectrum
AN) H I vel in set
AO) metal absorption in optical range
AP) metal emission in optical range
AQ) Ions were noted sometimes

AR) CO Line in set
AS) sum of possible redshift triggers
AT) Cepheid present for distance method
AU) RR-Lyrae present for distance method
AV) CMD used for distance method
AW) HB used for distance method
AX) TRGB used for distance method
AY) Red Clump used for distance method
AZ) SBF used for distance method
BA) Tully-Fisher used for distance method
BB) Faber-Jackson used for distance method
BC) GCLF used for distance method
BD) PNLF used for distance method
BE) SuperNova used for distance method
BF) Luminosity used for distance method
BG) sum of possible distance methods
BH) distance from distance method in Mpc min
BI) distance from distance method in Mpc max
BJ) Blank
BK) OK 4 V 1Up?, yes or no for valid velocity
BL) Chg from 1 row up, in columns to right
BM) RA-Degrees; change from 1row up
BN) RA in arc-min from 1row up
BO) Dec-Degrees; change from 1row up
BP) Dec in arc-min from 1row up
BQ) Blank
BR) Changes from row #
BS) RA-Degrees; change from row#
BT) RA in arc-min from row #
BU) Dec-Degrees; change from row#
BV) Dec in arc-min from row#
BW) Distance change from row#

Columns BK through BW are entered by the reader where needed by their selected galaxy's row.
BH) distance from distance method in Mpc

The K,L columns are written by the author's macro which converts the RA hms format into degrees and the Declination dms format into degrees.
These 2 columns are written by a macro not by an Excel equation. Excel expects when copying a cell having an equation, a paste into Excel keeps the formula, not the observed value. These cells are values, not equations, so the user has alternatives when using the data.

The author had intended to calculate spacial separation in light-years, but that requires a measured distance to the objects but distances are based on assumptions, not measured. The data for that calculation are provided but lacking certainty of distances.

Of course, anyone familiar with Excel can freely hide any columns when desired to reduce the number of columns. This done by selecting a column, a right click, then Hide
To bring back hidden columns select the columns to the left and right, the right click, and Unhide. For example, when column B is hidden, then A and C are adjacent with no B shown. Selecting A and C, then selecting Unhide brings back any hidden columns in the set of columns selected. With over 70 columns, hiding columns not needed at the moment makes data easier to find. Freezing column B, enables the galaxy name in column A to be shown at all times, while scrolling horizontally.

Hide; don't delete.

If a column has its data shown in a chart, that chart gets no data and no error, though blank.

The spreadsheet has a macro. Pressing the key combination of Ctrl-Q runs the macro to update 2 columns in the Galaxies worksheet. Entering the letter D does the conversion of the columns of RA and Dec in text into 2 columns as degrees. Entering the letter X exits the macro.

12.6 Galaxy Data from both references

This reference file in .xls format is compressed in a .zip format for convenient distribution.

Z-Galaxy-Data-WN.zip

The main worksheet, Galaxies, has over 1000 rows and over 70 columns. Compressing that content into a smaller page is impossible.

Many of the galaxies within our observable universe have a public position. Many, but not all, have a velocity (as km/s or z). Most of those also have a distance. Some have a size, measured in either light-years or arc-seconds.
These data were compiled, when available, into this data set.

A diameter in lightyears is entered, and/or angular dimensions, depending on each galaxy. Sizes of galaxies are not critical in this book as the author will not attempt to duplicate all the algorithms being used to convert a magnitude measurement into a distance.

The data are sorted in this order:

1) Sky quadrant, from NQ1 to SQ4,

2) Constellation by increasing Right Ascension,

3) Galaxy by increasing Right Ascension.

The Milky Way satellite galaxies are separated at the start of the list, as their close distances are unrelated to those of distant galaxies having nearby celestial coordinates.

The Magellanic Clouds are considered, in this data set, as Local Group galaxies. A study of groups of stars in both galaxies concluded their transverse velocity is too fast for them to be in orbit around the Milky Way. That conclusion takes them out of the list of Milky Way satellites which are assumed to be in orbit, by gravity.

The most distant galaxies are at the end of the list, where they are again sorted by coordinates.. Most of them are in the distant background to nearer galaxies in the foreground. When all are sorted only by coordinates, then their special relationship of foreground or background is not apparent.

By splitting galaxies into their respective hemispheres some perspectives are lost.

For example, galaxies in the NQ3 and SQ3 quadrants will share a portion of right ascension coordinates though having a separation in declination in that range. Unfortunately, the expansive Virgo galaxy cluster crosses the line between hemispheres so the relative North-South proximity is not apparent when galaxies are sorted like this in the list by hemisphere.

For example, consecutive galaxies in NQ3 might have similar RA positions to those in SQ3, but their declinations are slightly above and below a declination of 0°.

There is no convenient way to present 3-D relationships using tables of coordinates with right ascension and declination.

The spreadsheet file has 2 worksheets:

1) Galaxies, with data for the over 600 galaxies and 24 Abell clusters.

Most of these clusters are very distant.

2) Cepheids, with the subset of data from the 17 galaxies, beyond our Local Group, having a Cepheid.

The spreadsheet also has a number of charts, which are presented in this book.

The zip includes other files: 1) column definitions
2) TOC, which identifies by row number the respective quadrants in the long spreadsheet.

12.9 Constellation Data

Astronomers have defined a set of quadrants for the sky and assigned constellations to these quadrants.

The author created a reference file for the constellations, including their abbreviation, and their quadrant.

The original was in Excel, but it is distributed in pdf.

Z-Constellations.pdf

13 Hubble’s Law

Hubble’s Law describes a mathematical relationship between a galaxy’s red shift velocity and its distance.

13.1 Description

Excerpt from Wikipedia:

Hubble's law, also known as the Hubble–Lemaître law, is the observation in physical cosmology that galaxies are moving away from the Earth at speeds proportional to their distance. In other words, the farther they are the faster they are moving away from Earth. The velocity of the galaxies has been determined by their redshift, a shift of the light they emit toward the red end of the spectrum.

Hubble's law is considered the first observational basis for the expansion of the universe, and today it serves as one of the pieces of evidence most often cited in support of the Big Bang model. The motion of astronomical objects due solely to this expansion is known as the Hubble flow. It is often expressed by the equation v = H0D, with H0 the constant of proportionality—Hubble constant—between the "proper distance" D to a galaxy, which can change over time, unlike the comoving distance, and its speed of separation v, i.e. the derivative of proper distance with respect to cosmological time coordinate. (See uses of the proper distance for some discussion of the subtleties of this definition of 'velocity'.)

Hubble constant is most frequently quoted in (km/s)/Mpc, thus giving the speed in km/s of a galaxy 1 megaparsec (3.09×10^{19} km) away, and its value is about 70 (km/s)/Mpc. However, the SI unit of H0 is simply s^{-1}, and the SI unit for the reciprocal of H0 is simply the second. The reciprocal of H0 is known as the Hubble time. The Hubble constant can also be interpreted as the relative rate of expansion.

The parameters that appear in Hubble's law, velocities and distances, are not directly measured.

(Excerpt end)

Observation:

The last sentence in the excerpt clearly identifies the fundamental problem with Hubble’s Law. One must be explicitly clear what exactly IS directly measured. There is only 1 measurement.

A change in a wavelength in a galaxy spectrum from its expected value can be directly measured.

With current technology, this measurement probably has a small margin of error.

However, any change in a measured wavelength could have more than one explanation, so alternatives must be considered.

Any distance cannot be directly measured.
A distance can be calculated based on a few assumptions, such as dimming by distance. This is a simple calculation, but it must have a margin of error based on the reliability of the directly measuring the brightness of both the target object and the benchmark object.

13.2 Background

Excerpt from Wikipedia:

In 1912, Vesto Slipher measured the first Doppler shift of a "spiral nebula" (spiral nebula is the obsolete term for spiral galaxies), and soon discovered that almost all such nebulae were receding from Earth.
He did not grasp the cosmological implications of this fact, and indeed at the time it was highly controversial whether or not these nebulae were "island universes" outside our Milky Way.

Edwin Hubble is often incorrectly credited with discovering the redshift of galaxies.
These measurements and their significance were understood before 1917 by James Edward Keeler, Vesto Melvin Slipher, and William Wallace Campbell at other observatories.

Combining his own measurements of galaxy distances with Vesto Slipher's measurements of the redshifts associated with the galaxies, Hubble and Milton Humason discovered a rough proportionality of the objects' distances with their redshifts.

(Excerpt end)

Observation:

Slipher measured redshifts, not velocities.

The critical conclusion was “a rough proportionality of the objects' distances with their redshifts” so this means the red shift is increasing by an increasing distance to the object. The connection to distance is not to velocity.

The critical statement from this paper:

"Hubble discovered a rough proportionality between redshift of an object and its distance.”

Observation:
Hubble perceived the neutral hydrogen line red shift as proportional to distance; velocity is not involved.

The redshift is caused by the force of gravity pulling the neutral hydrogen atom toward the galaxy, or away from Earth. The redshift is from atoms moving in the line of sight, not from the galaxy.

There is a 2014 study titled:

"The Most Luminous z= 9-10 Galaxy candidates yet found: The Luminosity Function, Cosmic Star-Formation Rate, And The First Mass Density Estimate At 500 Myr"

Excerpt from this paper about galaxies with z from 9 to 10:

The identification of LBGs in the epoch of reionization makes use of the almost complete absorption of UV photons shortward of the redshifted Ly-alpha line due to a high neutral hydrogen fraction in the inter-galactic medium.

(Excerpt end)

The many neutral hydrogen atoms in the IGM absorb UV wavelengths to ionize, becoming a proton and electron. The proton capturing an electron emits the Ly-alpha line.
These galaxies are not moving at z from 9 to 10, because the extreme red shift is from activity in the IGM, not a velocity of the galaxy.

This study consistently uses z, not a velocity.

Only a change in a wavelength can be directly measured, recorded as z. It is impossible to directly measure a velocity.

The study explicitly states "the redshifted Ly-alpha line [is] due to a high neutral hydrogen fraction in the inter-galactic medium." The astronomers know the redshift is not a velocity.

13.3 Consistency

The study of high redshift galaxies confirmed the red shifted Ly-alpha line is being used for the measured redshift value.

This line originates with a proton in the line of sight capturing an electron. Therefore, the high red shift galaxies have a high red shift mechanism unlike other galaxies using the neutral hydrogen emission line.

Inconsistent methods of measurement result in inconsistent comparison of values. Comparing values from different methods can be a mistake.

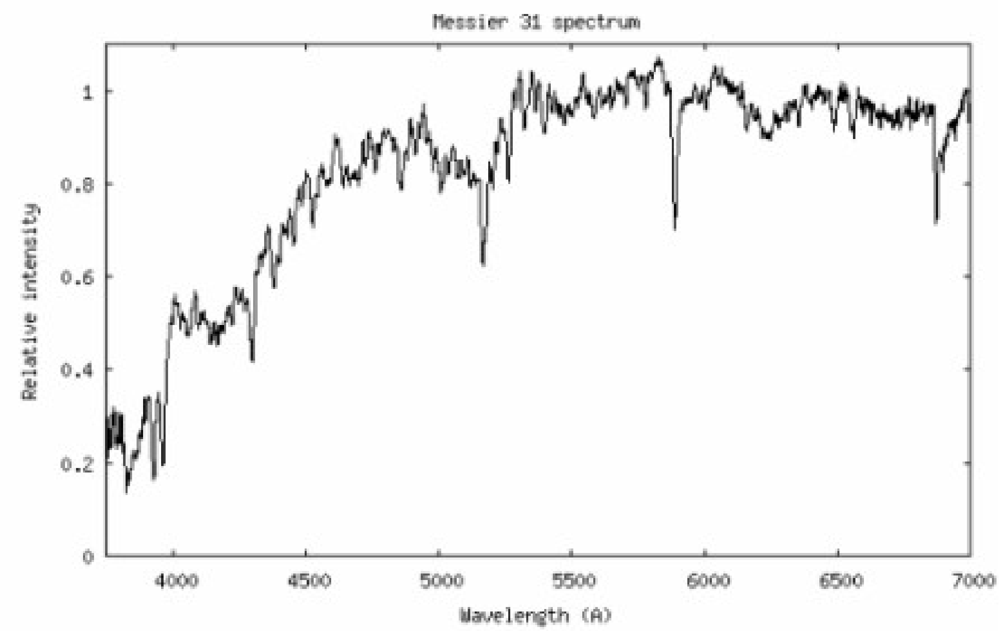
The galaxies in the survey were not identified. NED did not have an entry for the long galaxy names being assigned to these special galaxies. In other words, they do not have NGC numbers at this time.

Hubble's Law was based on neutral hydrogen emission line.
Any other wavelength change cannot be used because that was the perceived relationship at the time.
Any other line cannot be used with Hubble's Law.
M31, or Andromeda Galaxy, is well known to have a blue shift though the specific line is not always known

The direct measurement of the M31 blue shift mechanism was demonstrated by an astronomer at an observatory in France in 2013, when he captured a slice of the M31 corona spectrum.

This observation is found by:
"The radial velocity measure of nearby galaxies"

The following image is from that page:



This is clearly the somewhat flat distribution of frequencies observed with synchrotron radiation. If this measurement were from a star, then its distribution cannot be flat like this.

Synchrotron radiation cannot shift.

The entire spectrum is not shifting like with a Doppler effect; it spans the entire spectrogram, from ultraviolet to infrared.

M31 has the absorption lines for calcium ions (a pair below 4000 A). They show a Doppler Effect velocity of -401 km/s. This value is about the same velocity of the calcium ions moving away from the solar corona.

The spectrum clearly shows the M31 corona has a source of synchrotron radiation.

The page also includes spectrograms for 3 stars (in blue, green, red) have the distinctive hump of thermal radiation for the hottest star. Each star slopes down to around 7000 Angstroms, or infrared.

A spiral galaxy has a bulge of stars around the central core.
By this observation, there is an electrical current (moving charged particles) present near the corona. It is changing its path by a magnetic field resulting in the propagation of electromagnetic radiation. With this mechanism, it is called synchrotron radiation because that is how a synchrotron device works.

This spiral galaxy corona is crucial when measuring the galaxy spectrum. If only stars are in the sample, like at an edge, they generate thermal radiation. If the corona is in the sample, it has the frequency distribution as observed in the M31 spectrogram.

The calcium ions causing their absorption lines are in the line of sight to the M31 galactic corona. These absorption lines indicate nothing about a velocity of M31.

The spectrum of the corona slice is clearly not of a star. It is not from a gas, which can generate only emission lines from the individual ions.

A spiral galaxy like M31 is a source of synchrotron radiation.

The calcium absorption line in M31 cannot be used with Hubble's Law for 2 reasons:

1) It is not the hydrogen Ly-alpha absorption line,

2) It is negative; a negative distance is impossible.

It is impossible for the Ly-alpha to be blue shifted by the IGM.

If any galaxy has a measured blue shift, as a negative z or a negative velocity, then that measurement was a mistake using the wrong line in the galaxy spectrum. Nothing of a galaxy can be measured by absorption or emission caused by the presence of atoms in the line of sight.

13.4 Lateral motion

Astronomers had never attempted to measure a galaxy's lateral motion, not just a Doppler driven velocity in the line of sight, until recently.

The two Magellanic Clouds are galaxies close to our Milky Way but their far Southern position inhibits viewing by Northern telescopes.

Excerpt from Wikipedia:

Announced in 2006, measurements with the Hubble Space Telescope suggest the Large and Small Magellanic Clouds may be moving too fast to be orbiting the Milky Way.
In 2014, measurements from the Hubble Space Telescope made it possible to determine that the LMC has a rotation period of 250 million years.

(Excerpt end)

Excerpt from a space.com story about this measurement:

By pointing NASA's Hubble Space Telescope toward the two clouds, scientists began to catch a glimpse of the objects' histories. "Hubble's biggest contribution is enabling us to clock how fast the Magellanic clouds are moving," said Gurtina Besla, a researcher at the University of Arizona who studies dwarf galaxies.

In 2007, Besla overturned conventional wisdom when she suggested that the LMC and SMC were making their first orbit of our galaxy.
"They're moving too fast to have been long-term companions of the Milky Way," Besla said.

She used data from the European Space Agency's Gaia spacecraft to clock smaller, satellite galaxies orbiting the LMC, as well. And, understanding how these galaxies move has helped researchers better calculate the mass of the LMC. Current estimates put the LMC at about 100 billion times as massive as Earth's sun, or a quarter the mass of the Milky Way. Besla said this size means the LMC is about 10 times heavier than previously calculated.

(Excerpt end)

Observation:

It is ironic there are only 2 galaxies in the universe having an attempt to measure a transverse velocity, and both were fast, when the unjustified assumption is all galaxies have no lateral motion.

All other galaxies, lacking any attempt to measure any such motion, are just assumed to have motion only in the direction of their line of sight from Earth.

13.5 Definition of Hubble's Constant

Descriptions of this constant indicate its value is misunderstood.
From Wikipedia:

"The Hubble constant can also be interpreted as the relative rate of expansion."

Hubble's Law is based on the neutral hydrogen emission line being shifted by the distance the light travels through the intergalactic medium, or IGM.

This red shift has nothing to do with a fictitious expansion. This is the result of light interacting with atoms in plasma within the space between galaxies.

Cepheids are a distance benchmark and could measure this behavior in the line of sight to its host galaxy.

A Cepheid distance measurement establishes the ratio or relationship of z : D
This ratio applies to its host galaxy and others in a similar line of sight through the IGM.

Currently, there is no other reliable alternative.

Everything dims by distance. Stars require instruments having very high resolution to measure individual stars among the billions in a galaxy. Efforts to use the known luminosity of certain bright, giant stars also encounter this limitation.

The author did a detailed analysis of the study using supernovae to justify the false expansion, and it was riddled by many errors including mistakes with red shifts. Supernovae are not consistent, as they must be to qualify as a possible benchmark.

13.6 Consequences of Hubble's Law

Astronomers formed invalid conclusions using this law.

The excerpt included:

"Hubble's law is considered the first observational basis for the expansion of the universe, and today it serves as one of the pieces of evidence most often cited in support of the Big Bang model. "

This claim of evidence is quite unjustified.

Regardless of any absorption or emission line, any change in its value is explicitly limited to the line of sight.

It is impossible for a measurement in the line of sight to also measure transverse velocity.

Transverse motion can be measured only by repeating position measurements over time. This exercise was attempted for the first time in 2006, but only for LMC and SMC, the 2 closest galaxies to Earth.

It might take a number of human lifetimes to do this exercise with galaxies further away. The closest large galaxy is M31. It is somewhat close, being in the Local Group, but much further than the Magellanic Clouds.

Astronomers used Cepheids to calculate the distance to M31 at 2.54 Mly.

At that distance, it will take many human life times to measure any motion. Even if M31 were speeding sideways at the velocity of light, we would see it move only 1 light-year each year.

Many years are needed to measure changes in individual star locations because of the distance away.

This technique requires resolution to many individual stars. This becomes more difficult with increasing distance.
Given our current technology, one must accept a human life time is too brief for us to measure motion of distant galaxies.

Regardless of whether one accepts an unbounded universe or one believes it has invisible bounds, some of the galaxies we see in the universe are just so far away we can't measure them.

Since we cannot measure motion of distant objects, it is explicitly impossible to know the history of their motion.

At this point there are no galaxies having a correctly measured velocity. With no valid velocity measurements, the Hubble’s constant is impossible and invalid.

Therefore, Hubble’s Law and its assumed relationship between redshift velocity and distance are also invalid.

Therefore, there is no observational evidence supporting a big bang theory based on all distant galaxies moving away only in the line of sight, while having no attempt to measure transverse motion of any galaxy.

14 NED Redshifts

14.1 Photometric Red Shift

Photometric redshift is a measurement which is not based on a shift of a specific absorption or emission line, obtained by analysis using spectroscopy.

This method is inconsistent with the Doppler Effect cases described in the last section.

Excerpt from Wikipedia:

A photometric redshift is an estimate for the recession velocity of an astronomical object such as a galaxy or quasar, made without measuring its spectrum.
The technique uses photometry (that is, the brightness of the object viewed through various standard filters, each of which lets through a relatively broad passband of colours, such as red light, green light, or blue light) to determine the redshift, and hence, through Hubble's law, the distance, of the observed object.

The technique was developed in the 1960s, but was largely replaced in the 1970s and 1980s by spectroscopic redshifts, using spectroscopy to observe the frequency (or wavelength) of characteristic spectral lines, and measure the shift of these lines from their laboratory positions.

The photometric redshift technique has come back into mainstream use since 2000, as a result of large sky surveys conducted in the late 1990s and 2000s which have detected a large number of faint high-redshift objects, and telescope time limitations mean that only a small fraction of these can be observed by spectroscopy. Photometric redshifts were originally determined by calculating the expected observed data from a known emission spectrum at a range of redshifts. The technique relies upon the spectrum of radiation being emitted by the object having strong features that can be detected by the relatively crude filters.

As photometric filters are sensitive to a range of wavelengths, and the technique relies on making many assumptions about the nature of the spectrum at the light-source, errors for these sorts of measurements can range up to $\delta z = 0.5$, and are much less reliable than spectroscopic determinations. In the absence of sufficient telescope time to determine a spectroscopic redshift for each object, the technique of photometric redshifts provides a method to determine an at least qualitative characterization of a redshift.

For example, if a Sun-like spectrum had a redshift of $z = 1$, it would be brightest in the infrared rather than at the yellow-green color associated with the peak of its blackbody spectrum, and the light intensity will be reduced in the filter by a factor of two (i.e. $1+z$) (see K correction for more details on the photometric consequences of redshift).

(Excerpt end)

The most important assumption when using this method is there are “strong features that can be detected by the relatively crude filters.”

When there are no strong features, this method cannot provide a valid result.

Unfortunately, galaxy spectra lack strong features.
The description mentions a “Sun-like spectrum” but that is not like a galaxy.

Perhaps, this method could work with stars. Their spectrum is from thermal radiation, so it has a “strong feature” because the wave length having the highest intensity is associated with the light source temperature. The solar spectrum was provided in the section Star Types.

When trying to apply this method to galaxies, the result might be like finding a pattern in noise.

14.2 Galaxy examples.

There are no readily available examples of specific galaxies and their spectra which passed through this specific processing. When lacking other’s data, this book can provide real data to illustrate this exercise.

There are 2 spiral galaxy spectra in section Galaxy Types, with M31 and M33 but they used Cepheids for their distance.

There are also spectra of 17 galaxies in the section Cepheids.

None of these galaxies exhibit a “strong feature” to be affected by color filters as described.

The synchrotron radiation will exhibit no strong features like a star's spectrum can. Galaxies might have an emission line but whether it falls into a range of a filter could be random. An emission line comes from an atom and its motion, if any, and is not representative of the massive galaxy.

14.3 Student Exercise

Someone from Rice University posted an Astronomy Laboratory exercise in 2014. A link is not included because the details of the specific exercise are not important. Its title is (if some really wants to see):

Measuring the Redshift of M104 – The Sombrero Galaxy.

As an exercise, it will probably be purged and disappear from the internet eventually.

None of this description is about anything the student did. This is about the exercise and the analysis being done by software.

The student is given a spectrogram of M104 galaxy and the M104 measurements:
M104 z = 0.00342 and its velocity = 1024 km/sec.

The M104 spectrogram shows wave lengths from about 3900 Angstroms to 7200.

The student apparently has access to software which can identify lines from Mercury and Neon.
The software apparently calculates the z and velocity for these lines.

The software used these metallic lines to calculate a velocity which was off from expected for M104 by 68%.

The student is not learning where the M104 velocity came from.

Among the many mistakes the student might not recognize:

1) The spectrogram does not present the origin of the stated velocity.

2) Mercury and neon lines are always irrelevant. They are atoms in the line of sight and any measured motion is irrelevant. If the results had been closer than off by 68% the results are still meaningless.

The inappropriate spectrogram cannot reveal the spectrum an astronomer must have used for the M104 value, which is identified below after checking the set of 25.

The author did an exercise a student might have to do, finding the origin of the accepted velocity of M104.

The PDF has references, including NED.

The following are the spectra in NED for M104. There are 25 in the set. The origin of the M104 velocity is not in the spectrogram given to the student.

The NED spectra at the time of writing this did not include the spectra in the exercise, despite 25 in the set.

Image 1, from the integration of multiple telescopes, is the UV-Mid-IR band.

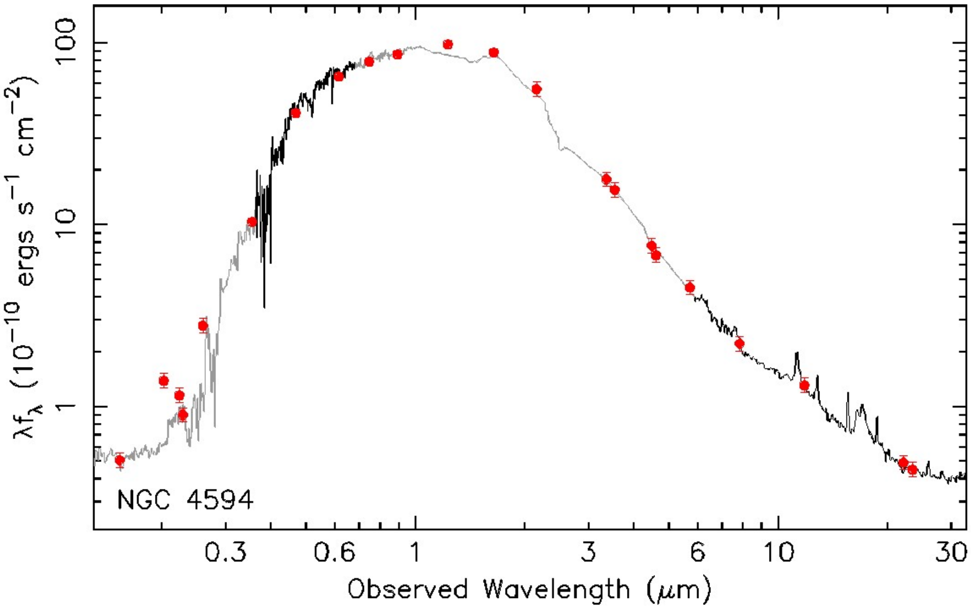


Image 2 is the UV band from the Nucleus Region.

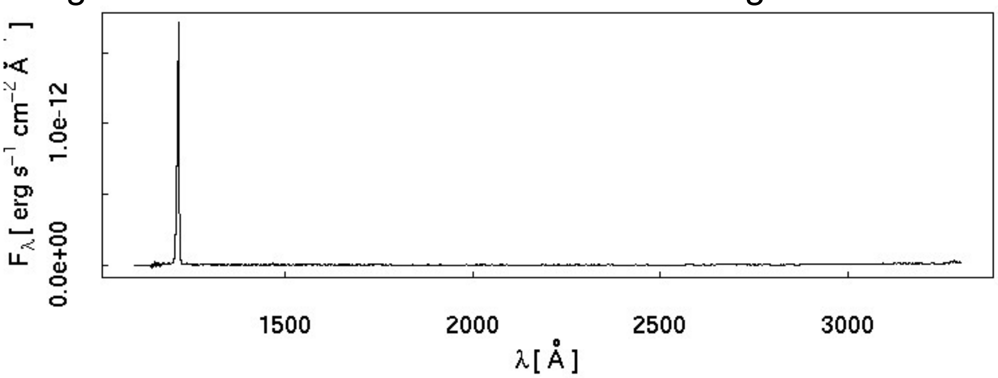


Image 3 is the Optical band from the Nucleus Region.

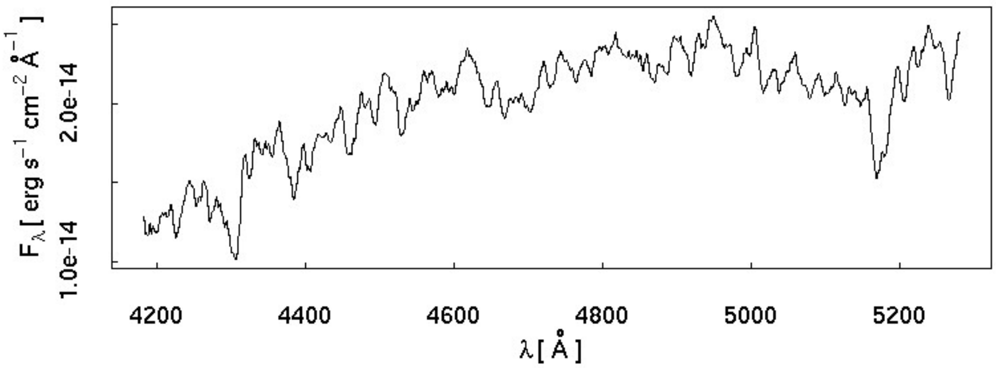


Image 4 is the Optical band from the Nucleus Region.

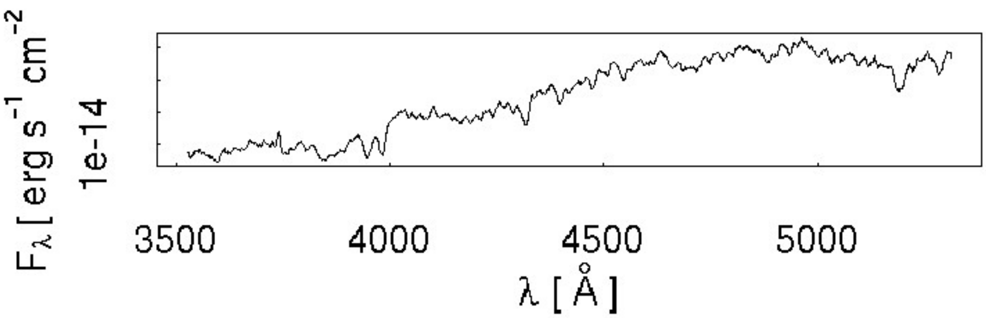


Image 5 is the Optical band from the Nucleus Region.

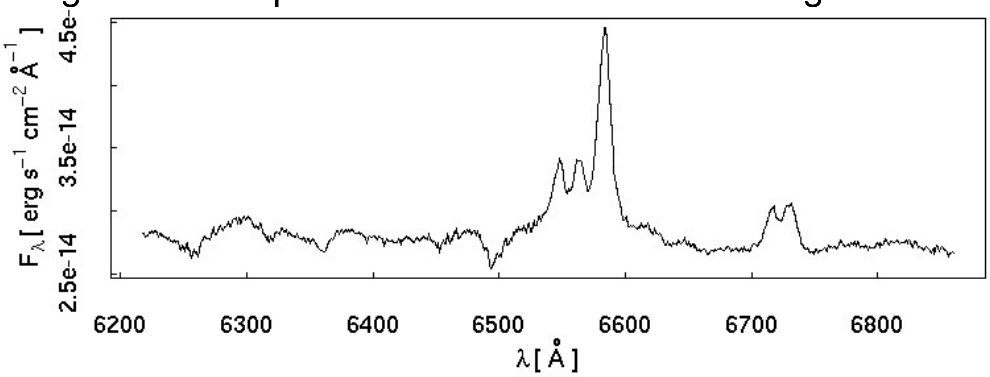


Image 6 is the Near-IR band from the Nucleus Region.

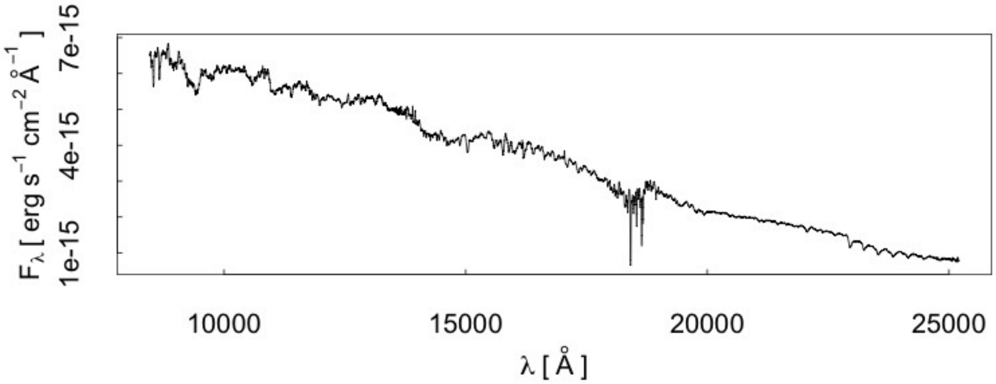


Image 7 is the Mid-IR band from the Nucleus Region.

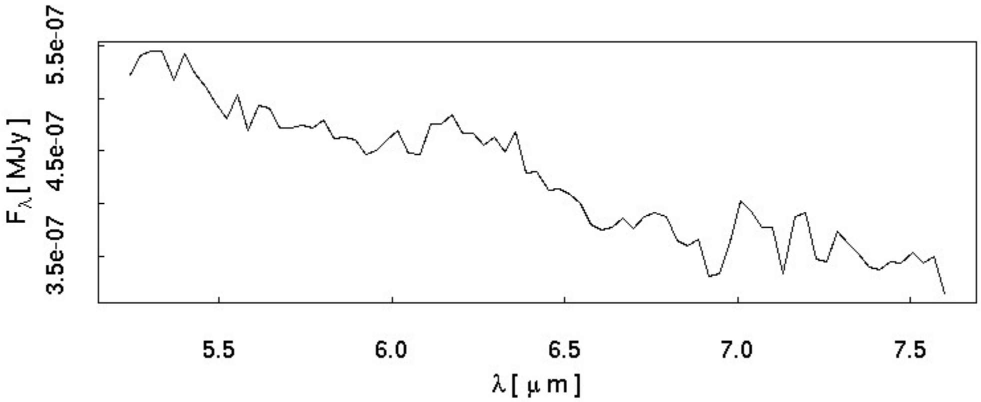


Image 8 is the Mid-IR band from the Nucleus Region.

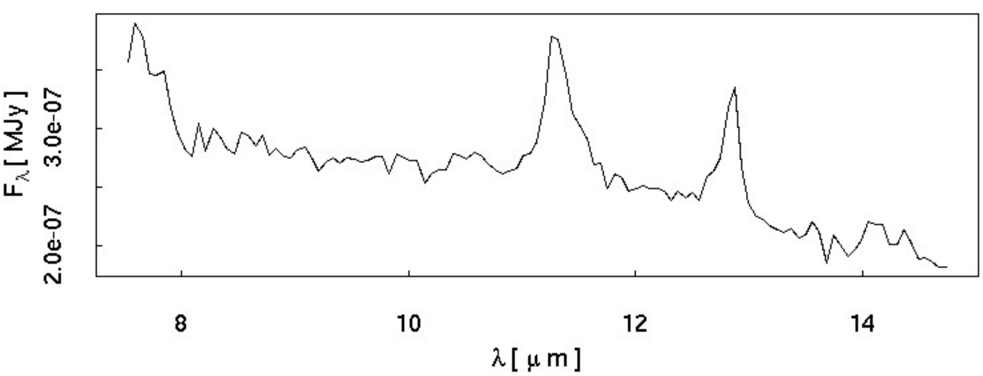


Image 9 is the Mid-IR band from the Nucleus Region.

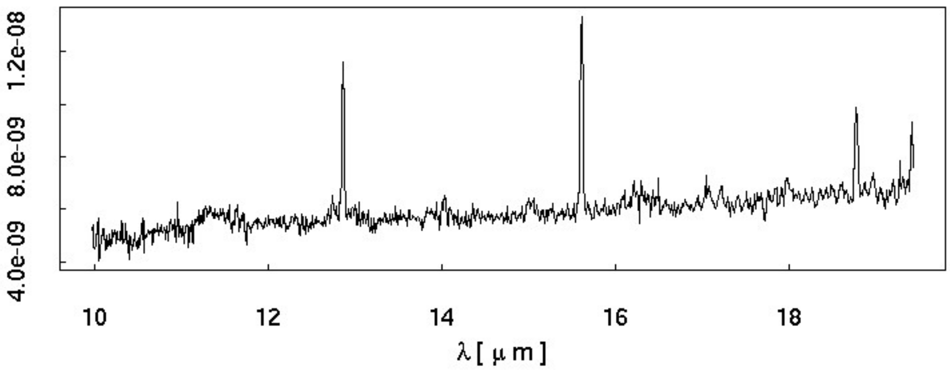


Image 10 is the Mid-IR band from the Nucleus Region.

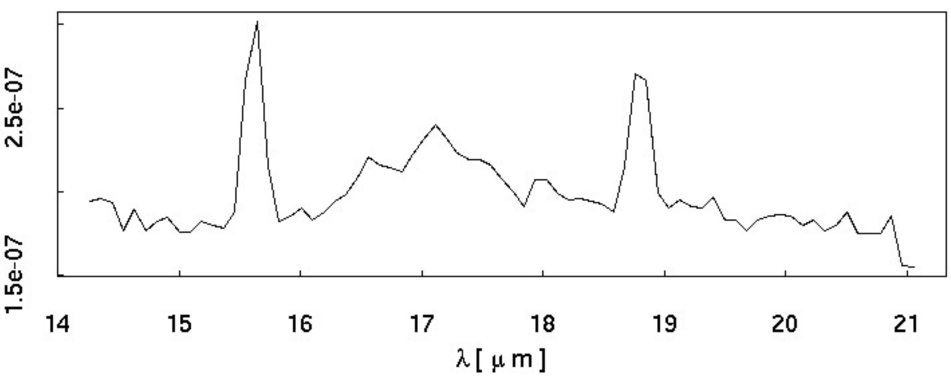


Image 11 is the Mid-IR band from the Nucleus Region.

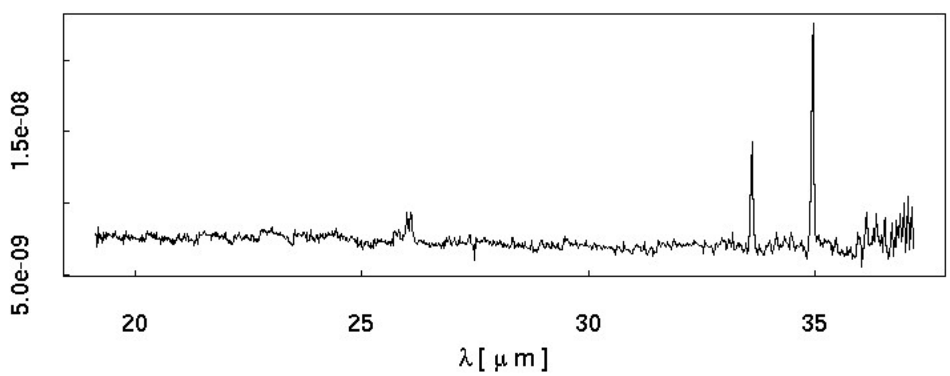


Image 12 is the Mid-IR band from the Nucleus Region.

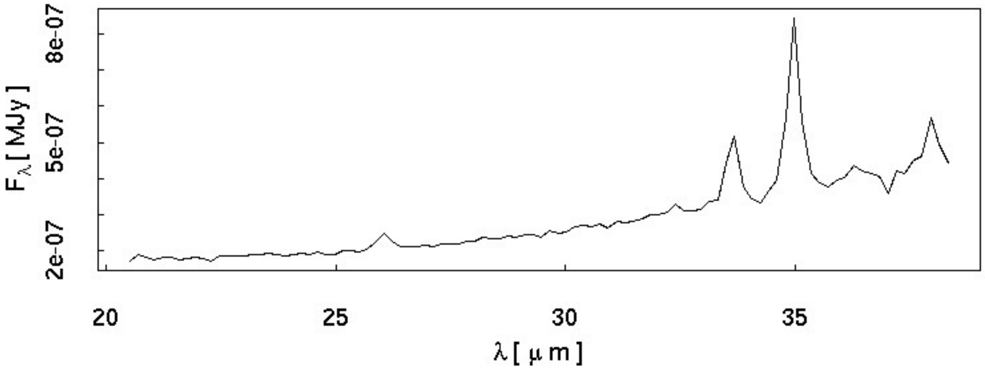
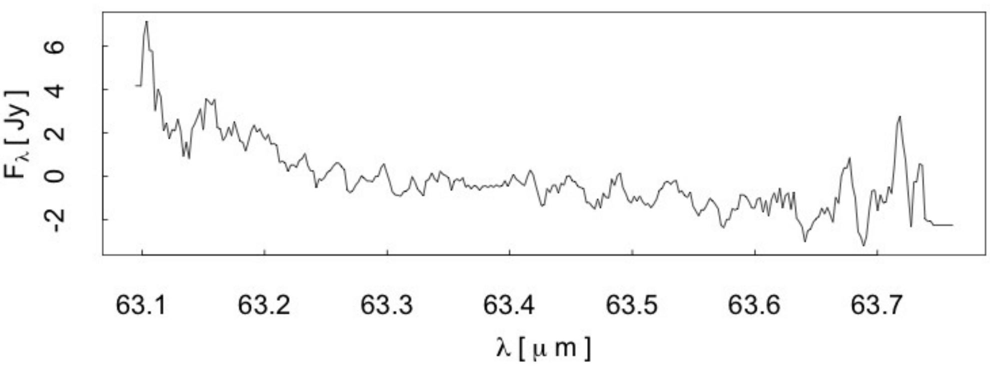
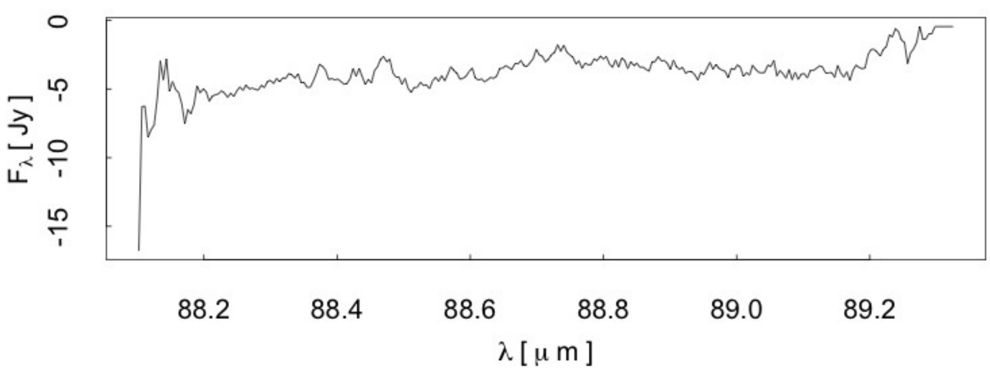


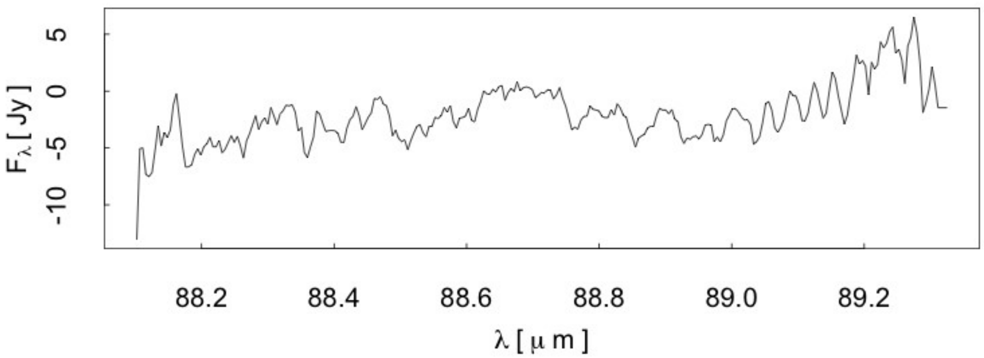
Image 13 is the [OI] 63μm line from the Nucleus Region.



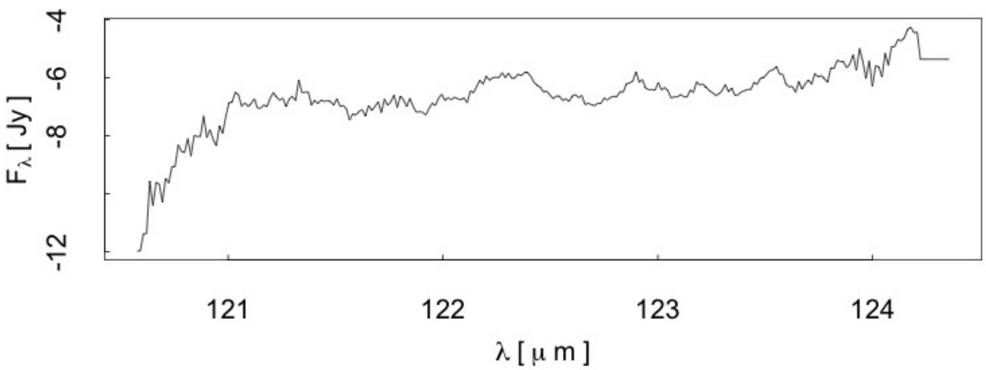
Images 14 and 15 are also O I.



Images 16 and 17 are [OIII] 88μm line from the Nucleus Region.



Images 18, 19, 20, 21 are [NII] 122μm line from the Nucleus Region.



Images 22, 23, 24 are [CII] 158μm line from the Nucleus Region.

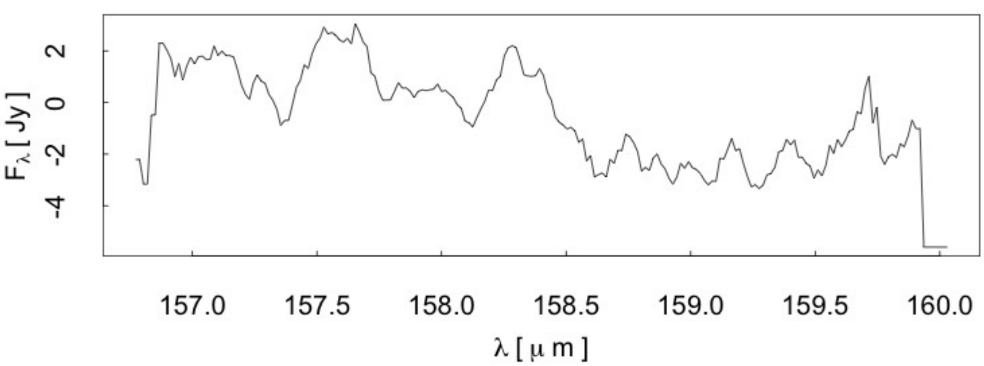
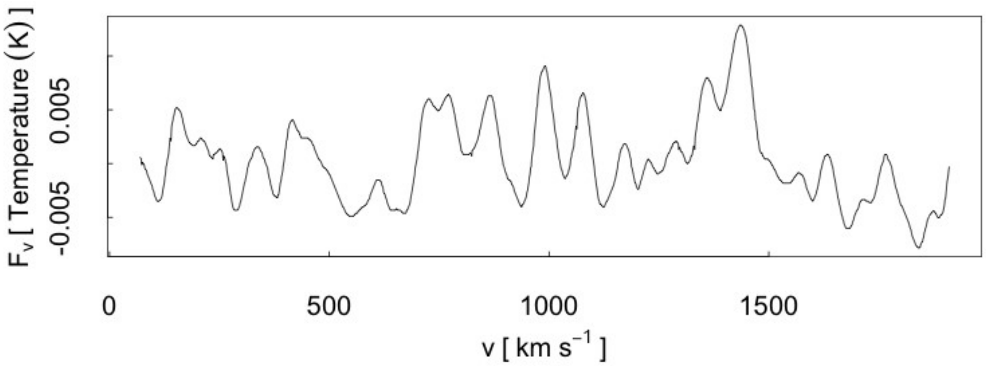


Image 25 is H I from Integrated Region.



Observations:

Image 1)

The long wavelengths in this infrared band offer nothing of interest here.

Image 2)

Lyman-alpha emission line was detected in UV band. It appears close to 1216 A so it was not moving fast at the moment of electron capture.

This line detection has nothing to do with a galaxy's velocity or distance.

Images 3, 4, 5)

There are candidate absorption and emission lines in the optical wavelength band. Some of the Balmer series line are in this range. If any of them are shifted, these atoms are in the line of sight and indicate nothing of the galaxy.

Images 6-12)

There is nothing if interest for a galaxy in these mid-infrared wavelengths.

Images 13-24)

These are spectrum captures of the galactic nucleus.

From Wikipedia:

The nucleus of the Sombrero Galaxy is classified as a low-ionization nuclear emission-line region (LINER).

A LINER galaxy is characterized by metallic emission lines.

These spectra of various elements (there are several for different elements) are worthless, when trying to measure a galaxy's velocity or distance. These atoms are in motion within the nucleus. It is a mistake to assume any motion they might have, in this narrow region, is at all related to the much larger galaxy.

There is no spectrum provided for these plots of velocities. The only possible origin of this plot is a number of emission lines around 21 cm. Each line had its wavelength measured from 21 cm. The difference was compared to 21 cm where diff / 21 cm = z. Next, each z was multiplied by c, resulting in a series of velocity with wavelength intensity as shown.

Image 25 might be the origin of the claimed velocity of 1024.

The first peak is around 1000 while the second could be around 1024.

Taking one peak out of a distribution is not a suitable measurement technique. In this case, the selected value must have a defined margin of error to address the inherent uncertainty in the mix when using this method.

If the student had been given this spectrum in place of the one in the exercise, they would have confronted the clear ambiguity when using the neutral hydrogen emission line.

Perhaps the exercise was just for the calculations, not to learn how the velocity is actually extracted from a measurement, like an astronomer must do.

It is impossible for this set of atoms in the line of sight, having differences in their 21 cm emission line to indicate the galaxy's proper velocity.

None of these peaks can be the galaxy's velocity in any direction. Using them is a mistake and then using them for a proper velocity compounds the mistake.

It is impossible to measure any 3-dimensional proper velocity when using only the line of sight.

14.4 Negative velocity

There at least 20 galaxies having a negative relative velocity.

A galaxy can have a negative velocity only when an astronomer is using a wrong method of measurement.

The 2 close spiral galaxies in our Local Group are M31 and M33. As noted in Section Galaxy Types, their velocity comes from the calcium ion absorption lines, which arise in the line of sight, not the galaxy. The optical spectrum from both was provided.

It is a mistake to measure an absorption or emission line in a galaxy spectrum.

Negative velocities are an alert to a mistake.

From the Data Set, these are the other galaxies having a negative velocity, so all are wrong:

Segue 2 dwarf, Ursa Minor dwarf, Pisces dwarf,

IC 10, IC 1613, Maffei 2, WLM,
NGC 147, 185, 221, 404, 598, 3031, 4192, 4569, 6166, 6822.

15 Cosmic Distance Ladder

Astronomers have several methods for determining the distance to a galaxy. This begins the topic. Several subsequent sections cover specific methods.

Excerpt from Wikipedia:

The cosmic distance ladder (also known as the extragalactic distance scale) is the succession of methods by which astronomers determine the distances to celestial objects. A real direct distance measurement of an astronomical object is possible only for those objects that are "close enough" (within about a thousand parsecs) to Earth. The techniques for determining distances to more distant objects are all based on various measured correlations between methods that work at close distances and methods that work at larger distances. Several methods rely on a standard candle, which is an astronomical object that has a known luminosity.

Almost all astronomical objects used as physical distance indicators belong to a class that has a known brightness. By comparing this known luminosity to an object's observed brightness, the distance to the object can be computed using the inverse-square law. These objects of known brightness are termed standard candles, coined by Henrietta Swan Leavitt.

Two problems exist for any class of standard candle. The principal one is calibration, that is the determination of exactly what the absolute magnitude of the candle is. This includes defining the class well enough that members can be recognized, and finding enough members of that class with well-known distances to allow their true absolute magnitude to be determined with enough accuracy. The second problem lies in recognizing members of the class, and not mistakenly using a standard candle calibration on an object which does not belong to the class. At extreme distances, which is where one most wishes to use a distance indicator, this recognition problem can be quite serious.
A significant issue with standard candles is the recurring question of how standard they are. For example, all observations seem to indicate that Type Ia supernovae that are of known distance have the same brightness (corrected by the shape of the light curve). The basis for this closeness in brightness is discussed below; however, the possibility exists that the distant Type Ia supernovae have different properties than nearby Type Ia supernovae. The use of Type Ia supernovae is crucial in determining the correct cosmological model. If indeed the properties of Type Ia supernovae are different at large distances, i.e. if the extrapolation of their calibration to arbitrary distances is not valid, ignoring this variation can dangerously bias the reconstruction of the cosmological parameters, in particular the reconstruction of the matter density parameter.

That this is not merely a philosophical issue can be seen from the history of distance measurements using Cepheid variables.

In the 1950s, Walter Baade discovered that the nearby Cepheid variables used to calibrate the standard candle were of a different type than the ones used to measure distances to nearby galaxies. The nearby Cepheid variables were population I stars with much higher metal content than the distant population II stars.

As a result, the population II stars were actually much brighter than believed, and when corrected, this had the effect of doubling the distances to the globular clusters, the nearby galaxies, and the diameter of the Milky Way.

(Excerpt end)

Observation:

The problems with assigning stars to 1 of the 3 populations were explained in section Star Types.

Walter Baade's discovery is crucial. Hubble's Law was based on relating distances obtained from Cepheids with the measured red shift values of galaxies. The method of each is important.

The method of measuring the red shift of each galaxy, with or without a Cepheid, is very important.

There is a section for Cepheids.

Several other methods can be immediately discarded.

One is the "standard siren" which is based on a claimed sound extracted from gravitational waves. The author's first book disposed of the non-existent gravitational waves. This book has a section for LIGO.

LIGO detects the earth tides caused by the Moon and Sun. LIGO is an abomination, never having evidence for its claims having elaborate fictional details.

There is no such thing as a gravitational wave so there can be no standard siren based on that mistake.

A second questionable method uses a supernova.

The often-cited study which claimed to find consistent supernovae, enabling them to be a candidate for a standard candle was riddled with errors. The most important mistake is the study used variable stars, not supernovae.

The study included a chart of their consistent light curves which never had an extreme brightening which should be a requirement for a claimed supernova. The mistake was confirmed within the study by including one example of the star’s spectrum and its change during the event. The spectrum is consistent with the change expected in a Cepheid variable star. The dimming of the stars was consistent because that light curve is the behavior of a Cepheid.

A supernova is expected to shed mass during the event. That significant change makes it rather unlikely for a number of these extreme events to follow the same luminosity curve. A Cepheid brightening in the course of its light curve is not like a supernova which abruptly increases in brightness by many magnitudes.
Each supernova is a unique event and is not a candidate for a standard candle. This study was described in the author’s first book.

The excerpt from Wikipedia continues:

The following four indicators all use stars in the old stellar populations (Population II):

- Tip of the red-giant branch (TRGB) distance indicator.
- Planetary nebula luminosity function (PNLF)
- Globular cluster luminosity function (GCLF)
- Surface brightness fluctuation (SBF)

(Excerpt end)

Each of the 4 will be addressed in section NED Distances.

16 NED Distances

NED identifies galaxies using specific distance calculation methods: Tully-Fisher Relation, Faber-Jackson Relation

Each has its detailed explanation below.

16.1 Tully-Fisher Relation

The Tully-Fisher Relation attempts to calculate a galaxy's distance based on a number of assumptions with luminosity.

Excerpt from Wikipedia:

The Tully–Fisher relation (TFR) is an empirical relationship between the mass or intrinsic luminosity of a spiral galaxy and its asymptotic rotation velocity or emission line width. It was first published in 1977 by astronomers R. Brent Tully and J. Richard Fisher. The luminosity is calculated by multiplying the galaxy's apparent brightness by $4\pi d^2$is its distance from us, and the spectral-line width is measured using long-slit spectroscopy.
Several different forms of the TFR exist, depending on which precise measures of mass, luminosity or rotation velocity one takes it to relate. Tully and Fisher used optical luminosity, but subsequent work showed the relation to be tighter when defined using microwave to infrared (K band) radiation (a good proxy for stellar mass), and even tighter when luminosity is replaced by the galaxy's total baryonic mass (the sum of its mass in stars and gas). This latter form of the relation is known as the Baryonic Tully–Fisher relation (BTFR), and states that baryonic mass is proportional to velocity to the power of roughly 3.5–4.

The TFR can be used to estimate the distance to spiral galaxies by allowing the luminosity of a galaxy to be derived from its directly measurable line width. The distance can then be found by comparing the luminosity to the apparent brightness. Thus the TFR constitutes a rung of the cosmic distance ladder, where it is calibrated using more direct distance measurement techniques and used in turn to calibrate methods extending to larger distance.
In the dark matter paradigm, a galaxy's rotation velocity (and hence line width) is primarily determined by the mass of the dark matter halo in which it lives, making the TFR a manifestation of the connection between visible and dark matter mass. In Modified Newtonian dynamics (MOND), the BTFR (with power-law index exactly 4) is a direct consequence of the gravitational force law effective at low acceleration.
The analogues of the TFR for non-rotationally-supported galaxies, such as ellipticals, are known as the Faber–Jackson relation and the fundamental plane.

(Excerpt end)

Observation:

There is a fundamental wrong assumption here.

Stars in galaxies of any type are not moving by the force of gravity.
It is impossible for only the attractive force of gravity to explain stellar motion in spiral galaxies. The clearly wrong assumption is expecting stars in a galaxy move just like planets around the Sun.

There is no justification for this assumption when there are only a few planets orbiting within a common plane around a much more massive single star. The Sun and planets move around the system's center of gravity in elliptical orbits. A galactic disk has billions of stars with clouds of gas and dust, within several arms. A spiral galaxy also has a bulge having many stars distributed within a sphere. The bulge is nothing like a single star to compare to the Sun and solar system. Our Sun is thought to move in a roughly circular orbit. Its orbit is considered disturbed by the millions of other stars also in the disk. Stars have a net positive charge which enables their motion to be driven by the Lorentz force from a spiral galaxy's magnetic field. Spiral galaxies do not resemble the solar system.

Several of these galaxies, including our Milky Way, have a bar between the galactic core and the start of the arms. Our solar system has nothing like that.

Gravity must have a diminished, to negligible, role in a spiral galaxy.

The rotation of the M31 disk was explained by this mechanism by astronomers in Spain, in 2010. No dark matter is needed when this cause explains the rotation.

Dark matter was needed as an excuse for why stars don't orbit like planets.

When TFR has an explicitly stated connection to non-existent dark matter, then TFR is connected to a mistake.

14.2 Galaxy example: NGC 4535.

The following images are from NED, or the NASA Extragalactic Database.

NGC 4535 has Cepheids so some of its data, including spectra, are in section Cepheids. The top of the Distances (54) list was shown. Several of the Cepheid distances were shown. Only the average of all the Cepheid distances was shown in that section.

Here is a lower segment of that display, where Tully-Fisher distances begin

Redshift-independent Distances for NGC 4535

View References in ADS (31) | 1 of 1 | (1 - 54 of 54)

(m-M) double	err(m-M) double	D(Mpc) double	Method char	Refcode char	Notes char
31.10	0.06	16.60	Cepheids	2003A&A...411..361K	cte MW STS03
31.25	0.04	17.80	Cepheids	2006ApJS..165..108S	LMC ZP
31.25		17.80	Cepheids	2008A&ARv..15..289T	
31.27	0.07	17.90	Cepheids	2000ApJ...529..768K	Z, Key Project
31.60		20.90	Cepheids	2006A&A...452..423P	27, VI
30.59		13.10	Grav. Stability Gas. Disk	1996AstL...22...71Z	
30.98	0.31	15.70	Sosies	2002A&A...393...57T	
31.04	0.09	16.10	Statistical	2013AJ....146...86T	Mean of Cepheids and Tully-Fisher
29.91	0.25	9.59	Tully-Fisher	1985A&AS...59...43B	B
29.91	0.41	9.59	Tully-Fisher	1985A&AS...59...43B	Diameter
29.91	0.23	9.59	Tully-Fisher	1985A&AS...59...43B	Mean of B mag and Diameter TF relation
29.93	0.40	9.68	Tully-Fisher	1981ApJ...248..408D	B

Here is the bottom segment of that display, where the Tully-Fisher distances end.

Redshift-independent Distances for NGC 4535

View References in ADS (31) | 1 of 1 | (1 - 54 of 54)

(m-M) double	err(m-M) double	D(Mpc) double	Method char	Refcode char	Notes char	SN Name char	Redshift double	H0 double
31.19	0.42	17.30	Tully-Fisher	1980ApJ...238..458M				65
31.30	0.51	18.20	Tully-Fisher	2009ApJS..182..474S				
31.33	0.50	18.40	Tully-Fisher	2009ApJS..182..474S	Malmquist cor.			
31.41	0.47	19.10	Tully-Fisher	1997ApJS..109..333W	A82, H, raw			75
31.47	0.45	19.60	Tully-Fisher	2007A&A...465...71T	K			
31.48	0.47	19.80	Tully-Fisher	2007A&A...465...71T	H			
31.49	0.46	19.90	Tully-Fisher	2007A&A...465...71T	J			
31.55	0.47	20.40	Tully-Fisher	1997ApJS..109..333W	A82, H, inv			75
31.62	0.47	21.10	Tully-Fisher	1997ApJS..109..333W	A82, H, cor			75
31.68	0.30	21.70	Tully-Fisher	2000A&A...355..835E	B			55
32.20	0.40	27.60	Tully-Fisher	2007A&A...465...71T	mean			
31.39	0.80	19.00	IRAS	1997ApJS..109..333W	A82, H			75

Here, the critical line on the display of 54 values is this excerpt with its distance:

16.10 Mpc | Statistical Method | Note: Mean of Cepheids and Tully-Fisher

According to this line, NED calculated the mean of many values with the result of 16.10 Mpc.

Apparently, no values are assigned more significance over others.

Perhaps, such an analysis using a bias is not impartial so it is avoided.

For comparison, the NED redshift distance using the redshift velocity and H0 is 27.19 Mpc

This redshift distance is 69% higher than statistical mean of distances using Cepheids and using TFR.

The problem is: there is no impartial distance measurement serving as the benchmark to check values from the respective methods, like Redshift, TFR, and Cepheids.

16.3 Faber-Jackson Relation

Excerpt from Wikipedia:

The Faber–Jackson relation provided the first empirical power-law relation between the luminosity and the central stellar velocity dispersion of elliptical galaxy, and was presented by the astronomers Sandra M. Faber and Robert Earl Jackson in 1976.

(Excerpt end)

Observation:

The term "velocity dispersion" should be defined. Excerpt from Wikipedia:

"In astronomy, the velocity dispersion (σ) is the statistical dispersion of velocities about the mean velocity for a group of astronomical objects, such as an open cluster, globular cluster, galaxy, galaxy cluster, or supercluster. By measuring the radial velocities of the group's members through astronomical spectroscopy, the velocity dispersion of that group can be estimated and used to derive the group's mass from the virial theorem. Radial velocity is found by measuring the Doppler width of spectral lines of a collection of objects; the more radial velocities one measures, the more accurately one knows their dispersion. A central velocity dispersion refers to the σ of the interior regions of an extended object, such as a galaxy or cluster.
The relationship between velocity dispersion and matter (or the observed electromagnetic radiation emitted by this matter) takes several forms in astronomy based on the object(s) being observed.

For instance, the Faber–Jackson relation for elliptical galaxies, and the Tully–Fisher relation for spiral galaxies. For example, the σ found for objects about the Milky Way's supermassive black hole (SMBH) is about 75 km/s. The Andromeda Galaxy (Messier 31) hosts a SMBH about 10 times larger than our own, and has a σ ≈ 160 km/s.

(Excerpt end)

Observation:

There is a wrong fundamental assumption here.

Stars in galaxies of any type are not moving by the force of gravity.
Stars have a net positive charge. That enables stars to move by the Lorentz force from a spiral galaxy's magnetic field. The rotation of the M31 disk was explained by this mechanism by astronomers in Spain, in 2010.

Stars rotate in a spiral galaxy disk by the magnetic force not by the force of gravity.

The assumption in the 1920's was the stars in a galaxy move just like planets around the Sun. This assumption was proven wrong when the rotation curve of a spiral galaxy like M31 was wrong. All 8 planets in the solar system rotate about the system's center of gravity including the Sun. The elliptical orbits of the widely spaced planets look nothing like the complex structure of the spiral arms, which contain billions of stars. M31 is estimated to have 1 trillion stars. Apparently, no one considered whether 1 trillion planets around the Sun would orbit just like the 8.

Instead of fixing the unjustified assumption, the wrong orbits, unlike a planet, were excused by the claim undetectable dark matter was the cause of any departure from the expectation.

The study in 2010 revealed the explanation for a galaxy's rotation curve in its magnetic field.

Instead of accepting this study, and admitting there is no dark matter as clamed, cosmology continues with the
Discredited dark matter excuse.

The recognition that stars have a positive charge is important to elliptical galaxies also.

In an elliptical galaxy, the stars are moving by electrodynamics, the mechanism for charged bodies in motion. The details are not crucial here, other than noting that using only gravity is wrong for galaxies, for many reasons, including dropping any mention of dark matter.

Cosmology invokes dark matter whenever a magnetic field is ignored. That mistake results in gravity being invoked. Since gravity is the wrong mechanism, then gravity still fails, even after invoking the wrong, temporary excuse of dark matter.

The description of this method mentions the velocity dispersion in the elliptical galaxy.

I checked Wikipedia for details of the ellipticals in the Messier list: M49, M87, M89, M105, and M110. Wikipedia offers extensive descriptions, but none mention velocity dispersion.

It is impossible to review this method when the proposed algorithm has no supporting data or examples of its actual application.

16.4 Branch Methods

HB and TRGB are described.

16.4.1 Horizontal Branch

Horizontal Branch is another method of estimating a galaxy’s distance without a detailed analysis of lines in its spectrum.

Excerpt from Wikipedia:

The horizontal branch (HB) is a stage of stellar evolution that immediately follows the red giant branch in stars whose masses are similar to the Sun's. Horizontal-branch stars are powered by helium fusion in the core (via the triple-alpha process) and by hydrogen fusion (via the CNO cycle) in a shell surrounding the core. The onset of core helium fusion at the tip of the red giant branch causes substantial changes in stellar structure, resulting in an overall reduction in luminosity, some contraction of the stellar envelope, and the surface reaching higher temperatures.

Horizontal branch stars were discovered with the first deep photographic photometric studies of globular clusters and were notable for being absent from all open clusters that had been studied up to that time. The horizontal branch is so named because in low-metallicity star collections like globular clusters, HB stars lie along a roughly horizontal line in a Hertzsprung–Russell diagram. Because the stars of one globular cluster are all at essentially the same distance from us, their apparent magnitudes all have the same relationship to their absolute magnitudes, and thus absolute-magnitude-related properties are plainly visible on an H-R diagram confined to stars of that cluster, undiffused by distance and thence magnitude uncertainties.

(Excerpt end)

The application of this method requires:

a) Resolution to individual stars in the galaxy,
b) Certainty in identifying the type of star being measured,

c) Certainty the star is not being dimmed by other than distance, such as dust in the galaxy, The difficulty of these requirements increases with the galaxy's actual distance,

With current imaging technology, this method is too limited for application beyond the Local Group.

16.4.2 Tip of the red-giant branch (TRGB) distance indicator

Tip of the red-giant branch (TRGB) is a primary distance indicator used in astronomy.

It uses the luminosity of the brightest red-giant-branch stars in a galaxy as a standard candle to gauge the distance to that galaxy. It has been used in conjunction with observations from the Hubble Space Telescope to determine the relative motions of the Local Cluster of galaxies within the Local Supercluster. Ground-based, 8-meter-class telescopes like the VLT are also able to measure the TRGB distance within reasonable observation times in the local universe

(Excerpt end)

The application of this method requires:

a) Resolution to individual stars in the galaxy,
b) Certainty in identifying the type of star being measured,

c) Certainty the star is not being dimmed by other than distance, such as dust in the galaxy,
The difficulty of these requirements increases with the galaxy's actual distance,

With current imaging technology, this method is too limited by its requirements for application beyond the Local Group, or "the local universe."

16.5 Luminosity Methods

The luminosity methods are: Luminosity distance, PNLF, GCLF, and SBF. Each method is described here.

16.5.1 Luminosity Distance

Luminosity Distance is another method of estimating a galaxy's distance without a detailed analysis of lines in its spectrum.

Excerpt from Wikipedia:

Luminosity distance DL is defined in terms of the relationship between the absolute magnitude M and apparent magnitude m of an astronomical object.

$M = m - 5(\log_{10} D_L - 1)$
which gives:

$$D_L = 10^{(m-M)+1}$$

where D_L is measured in parsecs. For nearby objects (say, in the Milky Way) the luminosity distance gives a good approximation to the natural notion of distance in Euclidean space.

The relation is less clear for distant objects like quasars far beyond the Milky Way since the apparent magnitude is affected by spacetime curvature, redshift, and time dilation. Calculating the relation between the apparent and actual luminosity of an object requires taking all of these factors into account.

The object's actual luminosity is determined using the inverse-square law and the proportions of the object's apparent distance and luminosity distance.
Another way to express the luminosity distance is through the flux-luminosity relationship. Since,

$F = L / (4\pi D_L^2)$
where F is flux ($W \cdot m^{-2}$), and L is luminosity (W). From this the luminosity distance can be expressed as:

D_L = square root of $(L / 4\pi F)$

The luminosity distance is related to the "comoving transverse distance" by

$D_L = (1 + z) D_M$

And with the angular distance parameter D_A by the Etherington's reciprocity theorem:

$D_L = (1 + z)^2 D_A$

where z is the redshift. is a factor that allows calculation of the comoving distance between two objects with the same redshift but at different positions of the sky; if the two objects are separated by an angle $\delta\theta$. the comoving distance between them would be $D_M \delta\theta$. In a spatially flat universe, the comoving transverse is exactly equal to the radial comoving D_C, i.e. the comoving distance from ourselves to the object.

(Excerpt end)

Observation:

There are many false assumptions in this method so one must doubt its results.

1) One mistake is the claim: “the apparent magnitude is affected
by spacetime curvature, redshift, and time dilation”

None of those things affects magnitude. Curvature and time dilation cannot apply, because they can apply only to the special observer. No observations by astronomers anywhere (because they are not the special observer commanding the motion of a distant celestial object using their reference frame, becoming special) can observe any fictitious results of curvature.

Therefore, the universe is “spatially flat” so Euclidean space is the correct context, just like for near objects.

A galaxy redshift is only a measured change in a specific emission line wavelength, so it is impossible to affect the magnitude of the full spectrum.

16.5.2 Planetary nebula luminosity function (PNLF)

Excerpt from Wikipedia:

Planetary nebula luminosity function (PNLF) is a secondary distance indicator used in astronomy. It makes use of the [O III] λ5007 forbidden line found in all planetary nebula (PNe) which are members of the old stellar populations (Population II). It can be used to determine distances to both spiral and elliptical galaxies despite their completely different stellar populations and is part of the Extragalactic Distance Scale.

The relative independence of the PNLF cutoff with respect to population age is harder to understand. The [O III] λ5007 flux of a PNe directly correlates to the brightness of its central star. Further, the brightness of its central star directly correlates to its mass and the central star's mass directly varies in relation to its progenitor's mass. However, by observation, it is demonstrated that reduced brightness does not happen.

(Excerpt end)

Observation:

This “does not happen” because there are too many baseless assumptions. This function depends on correctly understanding a star’s life cycle. As mentioned in section Star Types, the presence of elements is explained wrong by the defective fusion model. Robitaille’s LMH model, without internal fusion under impossible equilibrium, explains all stellar observations.

The application of the PNLF method requires:

a) Resolution to individual stars in the galaxy, and even to a rare planetary nebula,

b) Certainty in identifying the type of star being measured for its nebula expected to posses specific elements,

Perhaps PNLF can be improved but right now it is invalid.

16.5.3 Globular cluster luminosity function (GCLF)

A paper was published having the title:

Globular cluster luminosity function as distance indicator

Excerpt:

The accuracy of the method is impacted however by a potential dependency of the standard candle on environment as it provides a systematically shorter relative distance, by about 0.1-0.27 mag, between the Virgo and Fornax clusters when compared with their relative distances from the PNLF, SBF and Cepheid distance indicators (Villegas et al., 2010).
(Excerpt end)

Observation:

Perhaps GCLF can be improved but right now it is too uncertain beyond close galaxies.
Cepheids have a significant margin of error, so relying on them introduces more uncertainty.

16.5.4 Surface brightness fluctuation (SBF)

Excerpt from Wikipedia:

Surface brightness fluctuation (SBF) is a secondary distance indicator used to estimate distances to galaxies. It is useful to 100 Mpc (parsec). The method measures the variance in a galaxy's light distribution arising from fluctuations in the numbers of and luminosities of individual stars per resolution element.
The SBF technique uses the fact that galaxies are made up of a finite number of stars. The number of stars in any small patch of a galaxy will vary from point to point, creating a noise-like fluctuation in its surface brightness. While the various stars present in a galaxy will cover an enormous range of luminosity, the SBF can be characterized as having an average brightness. A galaxy twice as far away appears twice as smooth as a result of the averaging. Older elliptical galaxies have fairly consistent stellar populations, thus it closely approximates a standard candle. In practice, corrections are required to account for variations in age or metallicity from galaxy to galaxy. Calibration of the method is made empirically from Cepheids or theoretically from stellar population models.

(Excerpt end)

Observation:

The life cycle of stars is misunderstood, when based on the internal fusion mechanism. The LMH model explains stars better. Assumptions based on stellar populations lack an acceptable foundation for this SBF to be valid.

The application of the SBF method requires:

a) Resolution to individual stars in the galaxy, and even within an elliptical galaxy where only outer stars on the near side can be measured; its limit at 100 Mpc is acknowledged,

b) Certainty in identifying the type of star being measured which is currently expected to possess specific elements.

17 Charts

The author compiled a data set to support this book’s conclusions.

Here are several charts from the data set.

The charts go to 828 not 633 because the worksheet has about 10 rows of summary after each quadrant. These rows have no data for the charts. The gap in data is present but not always noticeable.

The initial rows in the data set are the Milky Way satellites followed by the Local Group.

After those 40 rows are the remaining galaxies beyond the Local Group and in the intergalactic medium out to about 60Mly

Those beyond 60Mly are in a separate list.

Mixing galaxies < 60 Mly with those > 60 Mly confuse foreground clusters with background clusters.

The sections Near Constellations and Far Constellations describe the galaxy distribution in each constellation, in each quadrant.

Charts refer to a measured wavelength change as z. Astronomers make a crucial mistake in treating a galaxy z as a velocity. It is impossible to measure a proper velocity with only a line of sight observation.

The H value, or Hubble's Constant can be calculated from the velocity and distance.

If Hubble's Constant were actually treated as a constant, then astronomers would consistently apply that specific value. Clearly by these charts, the constant is not applied as expected.

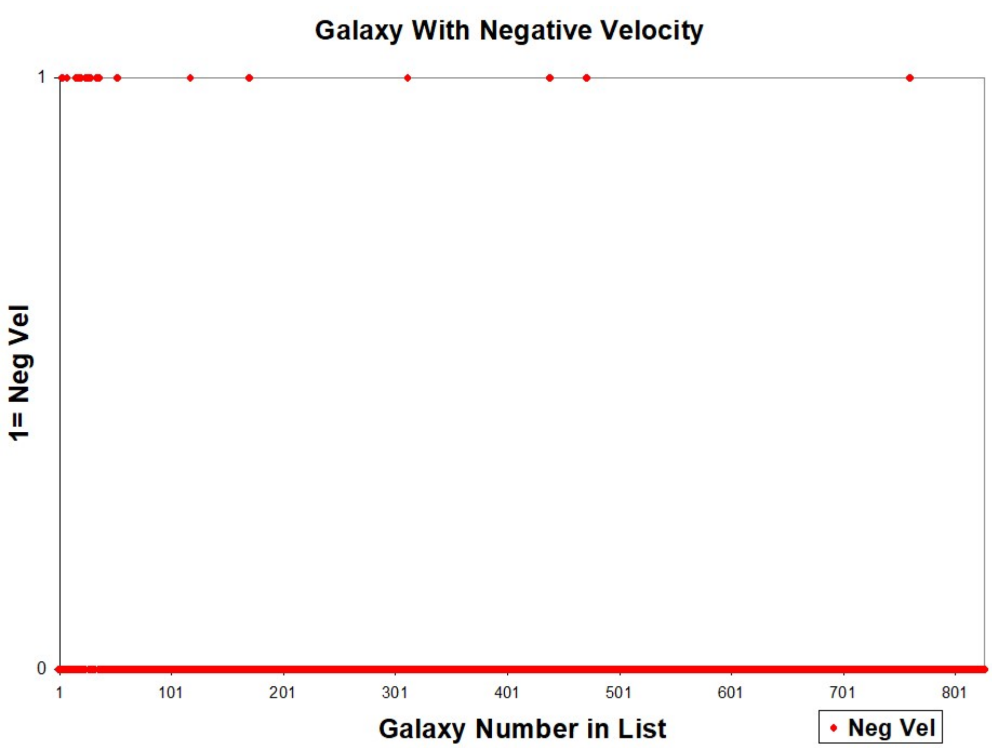
Any galaxy having a negative velocity is assumed to have h = 0, regardless of the claimed distance. There are only 20 having a negative z.

When a galaxy had no public red shift value (either z or velocity) then zero was used. There are few zeroes, only 14. They were included because this book is also about the distribution of galaxies among the clusters.

These charts will reveal the diversity of values being applied for a claimed constant which is supposedly evidence for universe expansion.

17.1 Negative Velocity

A negative velocity for a galaxy is unlikely. When one is recorded, the astronomer made a mistake by measuring an emission line. An emission line is never related to a galaxy velocity. Here are those 20 having a negative velocity of the 633 galaxies.



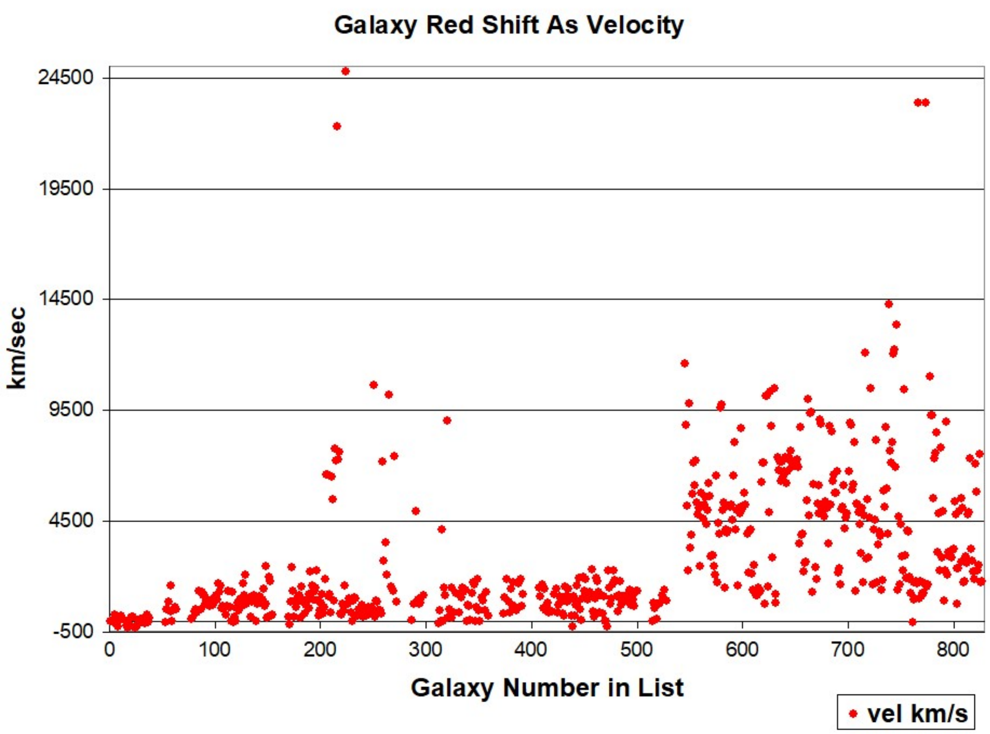
17.2 Calculating velocity from z

The conversion to velocity for z is simply multiplying z by the speed of light or 3×10^5 km/s

This is simply a mistake. In some cases, like in the exoplanet wobble method, or in atomic emission lines, a spectrum shift is directly related to the light source velocity.

This is NOT the case where this change in one specific wavelength was the result of the atom's motion, so the galaxy had nothing to do with this spectrum change in the line of sight to the observer.

As a result of this mistake, astronomers see numbers showing recession velocities. No velocity had been measured. The measurement was changed to a completely different meaning.



The pattern is the same but now there is a perceived motion from the units, though no motion was measured. Only a z from a proportional change in a specific wavelength from an atom in the line of sight is currently measured for every galaxy. The measurement

17.3 Calculating a distance from a velocity

Hubble's Law defined a simple relationship between a galaxy's velocity and its distance.

Hubble's constant has the units of km/s / Mpc

The simple conversion from Mpc to Mly is multiply by 3.26.

The equation is D = V / H

According to Wikipedia, H = 70 km/s / Mpc

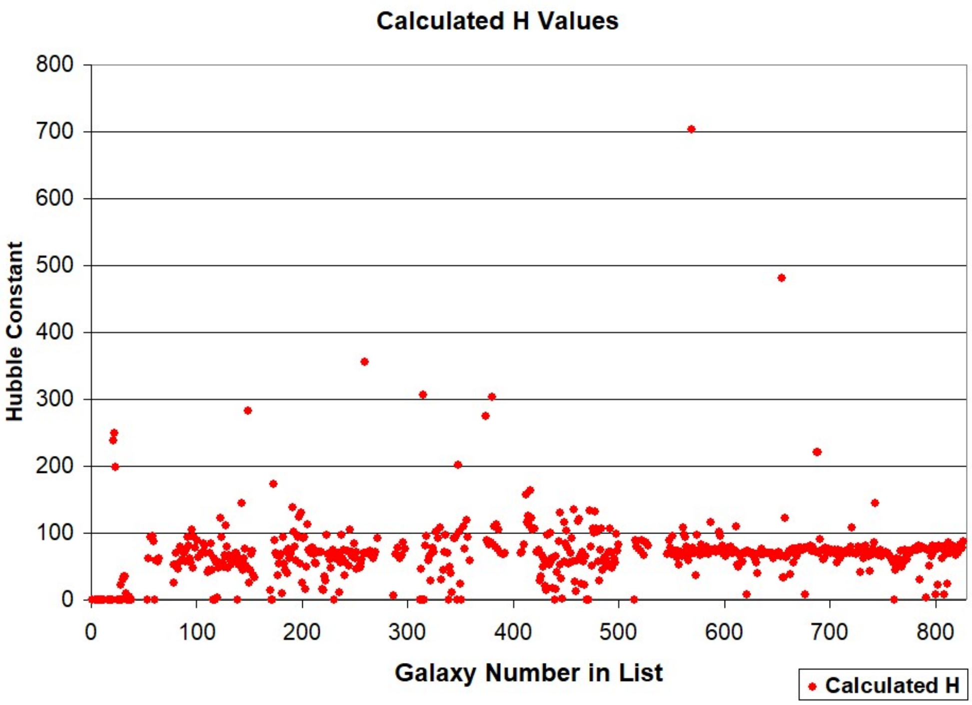
The 600+ galaxies have known V and D values.

The H value used by the astronomer for the D value is found by H = V/D

Because Hubble's Constant is called a constant, one could expect it is consistently applied with the accepted value.

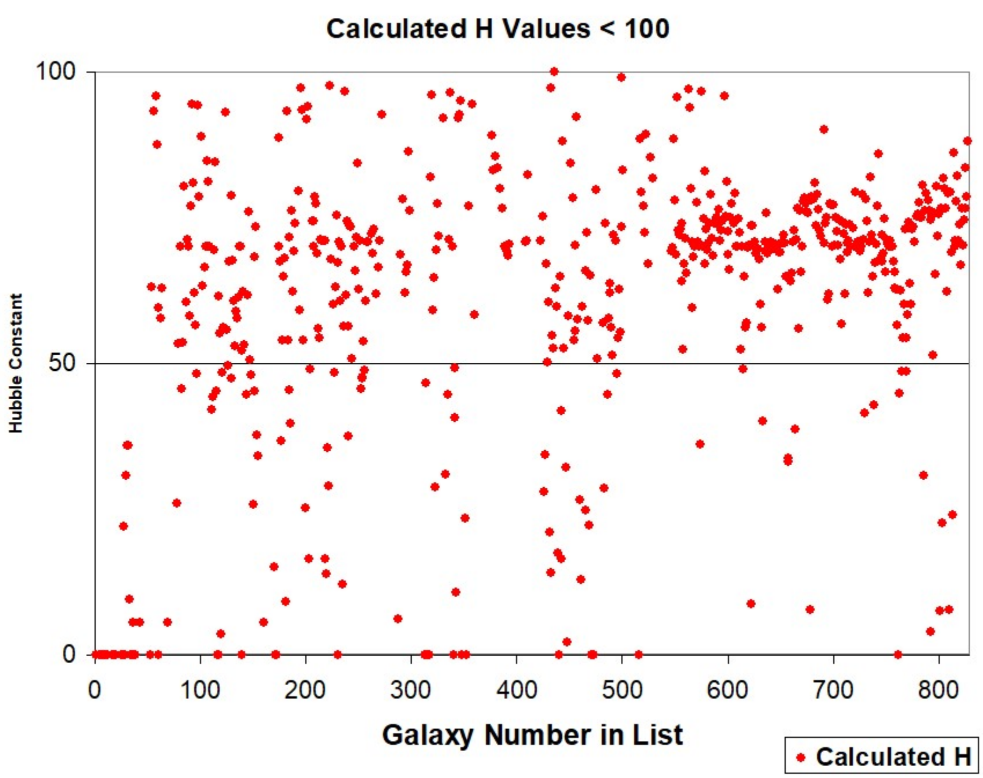
The application of D = V / H has H widely varying among the galaxies, with no readily apparent pattern. There might be one pattern at the far right: the galaxies with the highest red shifts did not show such diversity. One reason might be any astronomer should justify their stated distance for the galaxy being measured. With the high velocities, the distance will be great for any H. By using H values nearer the accepted H, the proposed distance might be unquestioned.

With this obvious diversity in H values being used, it is difficult to comprehend why the accepted value is so rarely applied.



There are a number having H > 100.

The same data were plotted but limited to H < 100. This is that limited set.



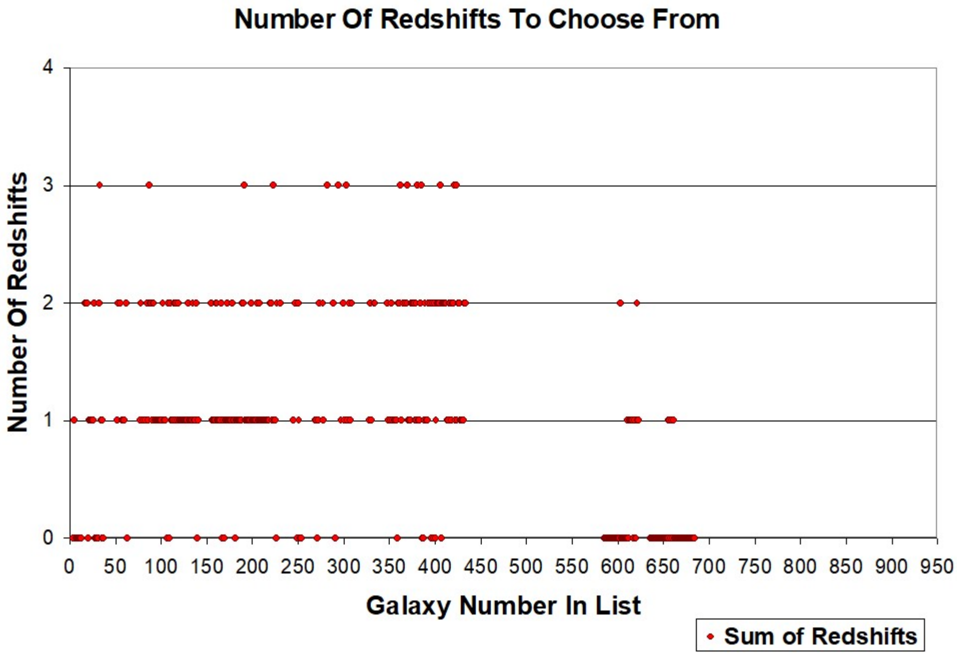
This plot reveals a scatter around the expected value of 70.

There is a inconsistency between the precision required for measuring and calculating a galaxy's z value and the diversity of H value selections for calculating its distance.

The methods identified in NED for specific galaxies are charted. These methods were explained in previous sections. The methods used by the respective galaxies are plotted in charts.

17.1 Possible redshifts identified in NED spectra

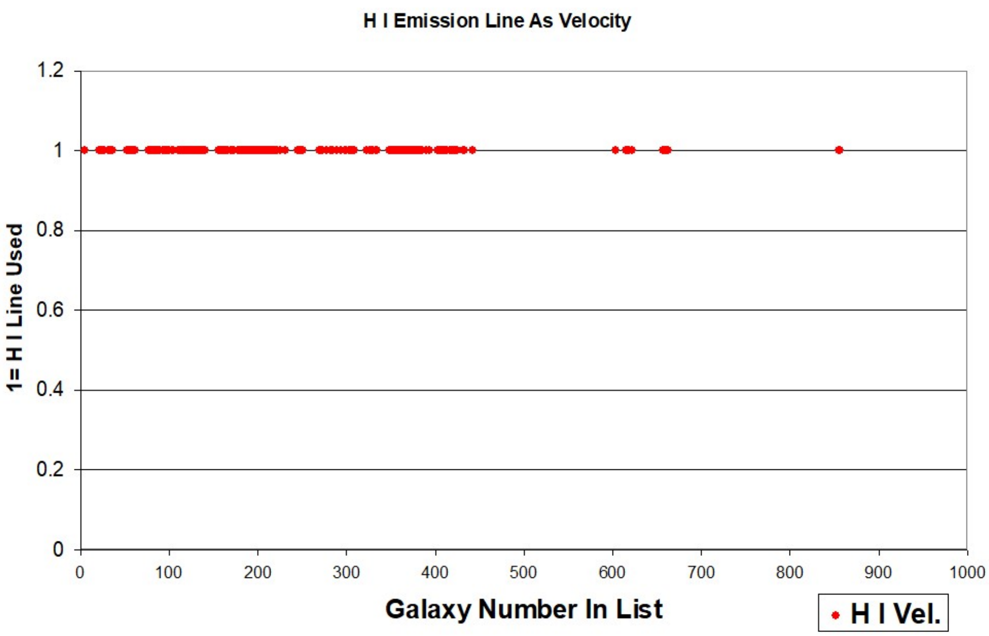
An astronomer can select a shifted emission or absorption line based on a seriously bad assumption. These lines are always from atoms in the line of sight, so it is literally impossible for any of them to indicate a 3-dimensional velocity of the galaxy behind it, in the line of sight.



When the spectrum contains no prominent absorption or emission lines, then the astronomer must use one of the distance calculations, based on luminosity. Those are the marks on the zero line.

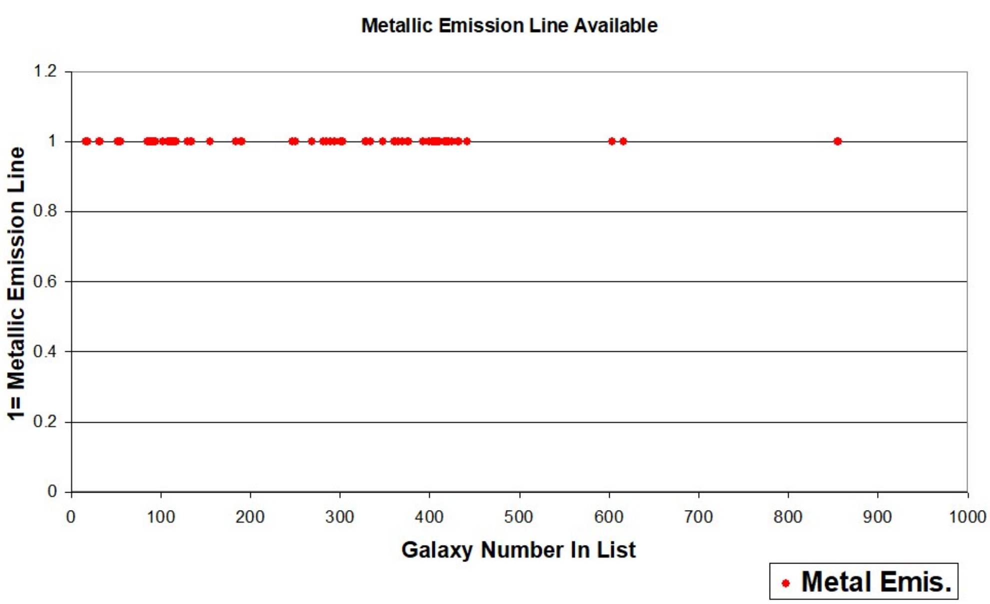
17.2 Using the H I line from neutral hydrogen

This line cannot indicate a galaxy’s velocity. Unfortunately, many have that mistake.



17.3 Using a metallic emission line

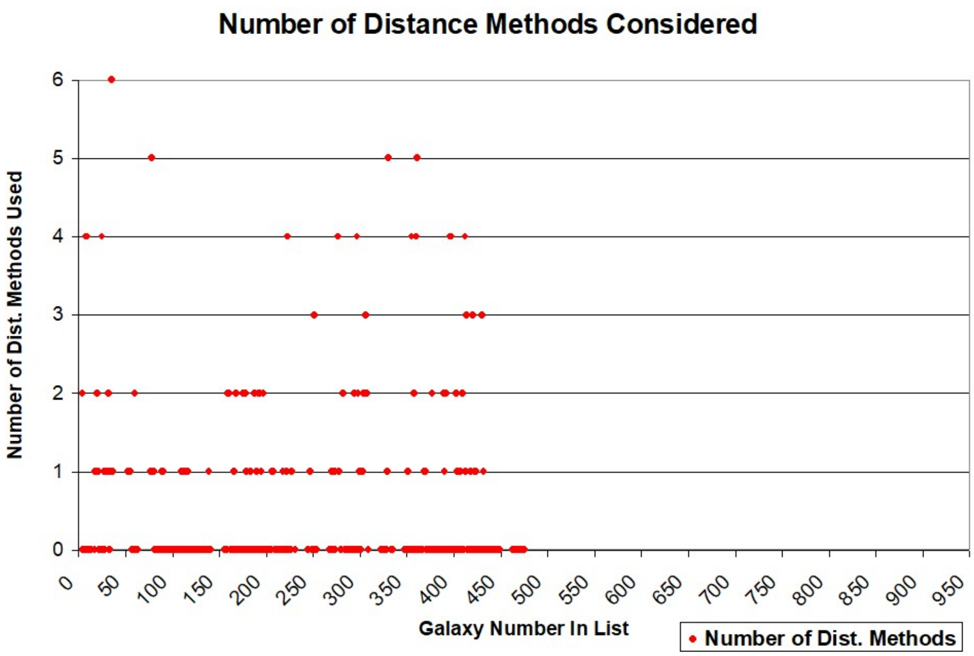
An emission line, from an atom in the line of sight, cannot indicate a galaxy's velocity. Unfortunately, many galaxies could have that mistake.



The most distant galaxies lack a spectrum but have only a measured magnitude, which can be used to estimate its distance.

17.2 Distance Methods

An astronomer has several methods which are available to calculate a distance when having no redshift. NED, in its Distances tab, identifies the methods being used.



18 Measuring Rules

For astronomers to provide useful measurements, these procedure changes are recommended when measuring galaxies:

Depending on the electrical demand of the galaxy, its synchrotron radiation usually extends from the ultraviolet, spanning a similar range, like thermal from, to infrared, though galaxies can extend to radio.
Ignore all absorption and emission lines.

The neutral hydrogen emission line is found in many galaxy spectra. The H I line cannot indicate a galaxy's velocity when it is only an atom in the line of sight.

Many galaxies have metallic ions moving in the vicinity of their galactic core, where the incoming electric current bends to power the arms and then the stars in the arms. The electric current generates a magnetic field. In a spiral galaxy, this magnetic field drives the rotation of the disk.

The galactic corona is part of this electrical circuit. The result is synchrotron radiation. The spectrogram of every galaxy shows a broad range of wavelengths from ultraviolet to far infrared with a similar intensity.

All absorption lines are generated by atoms in the line of sight to the galaxy, so the spectrogram shows them as absorbed from the galaxy's synchrotron radiation, with M31 having this known measurement of calcium ions. All emission lines are generated by atoms in the line of sight, so the spectrogram shows them as added to the galaxy's synchrotron radiation. The spectrum cannot indicate a galaxy velocity in 3-dimensions, as is being assumed.

The M31 galaxy in the Andromeda constellation is a good example of the mistake of using an absorption line for a velocity. A shift in that line cannot indicate the galaxy's proper motion. The stories in the popular media describe the certainty of an eventual collision with our Milky Way. There is no evidence to support such stories.

Sky surveys have been using optical imaging to capture data.

If this technique captures only a magnitude, so no spectrum with its absorption and emission lines are available for an invalid velocity. Methods like luminosity Distance attempt to measure a distance without measuring any lines.

However, the lines are not needed because the surveys are providing current celestial coordinates for each object. After many measurements over a long span of time, any motion should be detectable. This is one method for measuring the velocity (i.e., change in position over time) of a galaxy or quasar.

This is the same method used by Tycho Brahe and Johannes Kepler for measuring planetary motion.

A galaxy has another method available. By measuring the position of many individual stars, over a long span of time, the velocity as change in position over time can be calculated.

18.1 Galaxies

Only measurements supporting a distance calculation are worthwhile. One example is measuring the sporadic Cepheid which enables the calculation of an approximate distance to only that star. The distance from the Cepheid to the center of the disk or to the galactic center are not directly available to reduce the margin of error for this distance calculation from Earth to that particular galaxy.

Currently there is no galaxy in the universe having a known velocity and vector independent of an observer. An attempt was made using HST to measure the motion of the two Magellanic Clouds, using groups of stars in each cloud. I found few details other than their transverse motion was so fast, as to imply the two clouds are just passing by the Milky Way, and are not in orbit around it as was expected.

Another attempt was made with M31 with the assumption stars somewhat near the halo might be moving with the galaxy. This was difficult because the stars too far from the galaxy could appear like background stars and would appear to be among them. No motion was detected after measuring star locations for a period of time. The result suggests the stars were in the background and would not be moving for this measurement.

As noted elsewhere, many years might be required for a measurable change in a star's position at a distance of over 2.5 million light-years to M31, even at what one might consider a fast velocity for a galaxy of a trillion stars. The galactic disk rotates slowly as measured by the hydrogen emission lines from protons capturing electrons in the spiral arms.

Astronomers must be content with calculating only an estimated distance to a galaxy. Measuring a galaxy's velocity and vector requires the time of many generations recording many observations.

18.2 Quasars

The extremely energetic core of a quasar is a plasmoid. This entity generates intense synchrotron radiation covering a wide range of wave lengths from X-ray to radio.

Plasma behaviors are scalable. Plasmoids can be created in a laboratory. They were named by Winston Bostwick in 1956, following that observation. In a lab, Plasmoids are small and eventually dissipate. When scaled up greatly to the galactic scale, their life span increases by the same proportion.

A quasar provides nothing in its spectrum to derive anything about its velocity or distance.

There is not a defined typical quasar to serve as a luminosity benchmark. After their ejection from a Seyfert, their clouds of ions dim the visual wave lengths. Their AGN’s radiation could dim over time making brightness comparisons between quasars difficult or unjustified.

Currently, every quasar should have a red shift, stated as z or velocity. This value cannot be the quasar’s velocity, when the lines are from only atoms in the line of sight.

Therefore, every quasar’s red shift, velocity, and distance must be removed from the public values because all are invalid.

After many quasar position measurements over a long span of time, any motion should be detectable. This is the only method for measuring the velocity (i.e., change in position over time) of a quasar.

This is the same method used by Tycho Brahe and Johannes Kepler for measuring planetary motion.

19 Big Bang

The big bang theory arose after many galaxies were measured having a red shift. The theory's history and future are discussed.

19.1 Hubble Flow

Before expansion, cosmology had the Hubble Flow.

Excerpt from Wikipedia:

Combining his measurements of galaxy distances with Vesto Slipher and Milton Humason's measurements of the redshifts associated with the galaxies, Hubble discovered a rough proportionality between redshift of an object and its distance. Though there was considerable scatter (now known to be caused by peculiar velocities—the 'Hubble flow' is used to refer to the region of space far enough out that the recession velocity is larger than local peculiar velocities), Hubble was able to plot a trend line from the 46 galaxies he studied and obtain a value for the Hubble constant of 500 km/s/Mpc (much higher than the currently accepted value due to errors in his distance calibrations).
At the time of discovery and development of Hubble's law, it was acceptable to explain redshift phenomenon as a Doppler shift in the context of special relativity, and use the Doppler formula to associate redshift z with velocity.

Today, in the context of general relativity, velocity between distant objects depends on the choice of coordinates used, and therefore, the redshift can be equally described as a Doppler shift or a cosmological shift (or gravitational) due to the expanding space, or some combination of the two.

(Excerpt end)

Observation:

There is a simple mistake. The phrase "redshift can be equally described" explicitly states a redshift must be interpreted. Astronomers have accepted any change in a spectrum is a redshift of the galaxy. The description of the term is knowingly ambiguous. The flexibility enables the lack of accountability for correct use.

One goal of this book is explaining how every galaxy redshift measurement is of atoms in the line of sight. Until astronomers take the time, with many position measurements to actually measure the 3-dimensional proper velocity of a particular galaxy, no galaxy has a measured proper velocity with a vector independent of any observer. Now redshift is explicitly a velocity only in the line of sight, relative to Earth.

The term redshift refers only to the line of sight, NOT the galaxy.

Even if all the conclusions in this book are ignored, a crucial fact remains. A Doppler effect is explicitly limited to the line of sight, because it is impossible for changes in a wavelength to indicate transverse motion.

There is no galaxy in the universe having a measured velocity and vector with both independent of any observer.

There are thousands or more of galaxies in our observable universe.

Until now, astronomers and cosmologists never distinguished between measuring atoms in the line of sight and the much larger celestial object behind them.

Therefore, there is no suitable evidence for an expanding universe or for a big bang to set in motion this illusion of everything in recession, directly away from Earth.

There is no suitable evidence to set an age for the universe. An age certainly cannot be based on false velocities of every galaxy and quasar.

As far as I know, cosmologists never admitted that with everything assumed to be in recession directly in line with Earth, the Earth must be the site of the initial big bang event.

Putting the Earth at the center or origin of the universe should immediately demonstrate to everyone that cosmologists are making mistakes with the data, either with their measurement or interpretation.

From the very beginning, with Hubble and Slipher, every redshift measurement ignored the lack of data for transverse motion.

If only 1 galaxy is found having any transverse motion, then the entire theory of universe expansion based on 1-dimensional (literally or practically confined to the **line** of sight) values of velocity and distance must be treated as a failure.

Every celestial object has a 3-D position, as often described by RA, declination, and distance.

Every celestial object has a 3-D velocity, as often described by left/right, up/down, forward / away (or in / out).

The big bang theory is fatally flawed when treating everything in the universe as moving only in the line of sight. Everything we can see in the universe has size, measurable by 3 dimensions in most cases; a uniform sphere requires only one dimension value, as either a radius or diameter.

The fundamental mistake is treating every distant celestial object as a point in our line of sight and having no behavior beyond that line, in 3-dimensional space.

The invocation of relativity in the description of Hubble Flow reveals the utter confusion in cosmology.

Space-time is the context of only the special observer with their incremental change in position during each increment of time. Relativity defined a behavior called curvature where the changes in position were changed to curve the path as could occur from a gravitational field. Only the path is being changed. There is no change to physical space which is not a thing so it cannot be changed. There is no such thing as curved space. Space cannot have a topology

In classical physics, space has no observed or defined limits. Within this space there is much stuff, like galaxies, stars, planets, and moons

The crucial point with the big bang is: there is no need for the completely implausible theory of a big bang which has these flaws:

a) It puts the entire universe in extreme motion, when there is no galaxy or quasar having a measured, vectored motion independent of an observer.

b) The big bang event has too many unknowns with no possibility of learning the answers: 1) we can measure only the stuff in our observable universe; so it is impossible to measure the extent of what is beyond what our technology can measure,

2) it is impossible to know the composition of the universe before the initial explosion, 3) it is impossible to identify the cause or trigger of an explosion of an unknown object, and 4) it is impossible to predict the sequence of development or evolution between a) the initial explosion of unknown contents.

b) to the objects in our observable universe and c) to the unknown objects beyond our observable universe.

c) There is no evidence for any of the many steps in a very complicated sequence, which began with an unknown entity, despite the widely publicized details, even down to fractions of a second. The fiction is as elaborate as possible, though having no proven mechanisms involved. From start to end, all is conjecture.

The CMB was claimed as one sign of evidence but its claimed measurement has been thoroughly discredited by Dr. Robitaille. He has published many papers on the CMB measurements and analysis and many excellent videos on his Sky Scholar channel on YouTube. The CMB is the thermal radiation noise from molecular vibration in Earth's oceans. Water is a potential problem for any instrument in the radio frequency band, like for the CMB.

There was no big bang. Perhaps a first step in reforming cosmology is the elimination of its mythical creation story, called the big bang.

20 LIGO

This section is about LIGO and its legacy with modern physics. LIGO claims to be a new mechanism for observing the universe, by measuring a theoretical gravitational wave.

LIGO also claims to detect a black hole, a neutron star, and a ripple in space-time.
LIGO also claims to confirm Einstein's theory of relativity (both special and general).
LIGO's data and conclusions are the basis of a new branch of science, gravitational physics.

LIGO claims to have detected many gravitational waves coming from distant astrophysical sources. All aspects of this story are described, including terms and methods.

The history of LIGO's claims is presented enabling the reader to make their own conclusions on LIGO's legacy, based on the real data.

20.1 Gravitational Wave

This section describes the concept of a gravitational wave, proposed by Einstein's relativity.

Detecting a gravitational wave (GW) must be done indirectly because the GW has no real definition enabling a direct measurement.

LIGO is the Laser Interferometer Gravitational-Wave Observatory which was designed to detect these theoretical gravitational waves.

LIGO claims each GW detection, announced to the public, is from an astrophysical source, describing a binary of large masses (either is a black hole or neutron star) which spiral, collide, merge, and finally form only one black hole at the end.

LIGO will be described to explain its method of detection.

20.2 Gravitational wave origin

The origin of the theoretical gravitational wave might be trivia but here is its short story.

Excerpt from Wikipedia:

In 1905, Henri Poincaré proposed gravitational waves, emanating from a body and propagating at the speed of light, as being required by the Lorentz transformations and suggested that, in analogy to an accelerating electrical charge producing electromagnetic waves, accelerated masses in a relativistic field theory of gravity should produce gravitational waves. When Einstein published his general theory of relativity in 1915, he was skeptical of Poincaré's idea since the theory implied there were no "gravitational dipoles".
Nonetheless, he still pursued the idea and based on various approximations came to the conclusion there must, in fact, be three types of gravitational waves (dubbed longitudinal-longitudinal, transverse-longitudinal, and transverse-transverse by Hermann Weyl).

However, the nature of Einstein's approximations led many (including Einstein himself) to doubt the result.
In 1922, Arthur Eddington showed that two of Einstein's types of waves were artifacts of the coordinate system he used, and could be made to propagate at any speed by choosing appropriate coordinates, leading Eddington to jest that they "propagate at the speed of thought". This also cast doubt on the physicality of the third (transverse-transverse) type that Eddington showed always propagate at the speed of light regardless of coordinate system.
In 1936, Einstein and Nathan Rosen submitted a paper to Physical Review in which they claimed gravitational waves could not exist in the full general theory of relativity because any such solution of the field equations would have a singularity. The journal sent their manuscript to be reviewed by Howard P. Robertson, who anonymously reported that the singularities in question were simply the harmless coordinate singularities of the employed cylindrical coordinates.
Einstein, who was unfamiliar with the concept of peer review, angrily withdrew the manuscript, never to publish in Physical Review again.

Nonetheless, his assistant Leopold Infeld, who had been in contact with Robertson, convinced Einstein that the criticism was correct, and the paper was rewritten with the opposite conclusion and published elsewhere.
In 1956, Felix Pirani remedied the confusion caused by the use of various coordinate systems by rephrasing the gravitational waves in terms of the manifestly observable Riemann curvature tensor. At the time this work was mostly ignored because the community was focused on a different question: whether gravitational waves could transmit energy. This matter was settled by a thought experiment proposed by Richard Feynman during the first "GR" conference at Chapel Hill in 1957. In short, his argument known as the "sticky bead argument" notes that if one takes a rod with beads then the effect of a passing gravitational wave would be to move the beads along the rod; friction would then produce heat, implying that the passing wave had done work. Shortly after, Hermann Bondi, a former gravitational wave skeptic, published a detailed version of the "sticky bead argument".

(Excerpt end)

Observation:

From the beginning in 1922, gravitational waves were in doubt. Einstein himself tried to publish a paper denying them but withdrew that paper after being convinced his conclusion was wrong.
The account is not clear whether Einstein or Infeld wrote the final paper bringing the gravitational wave back to relativity.

20.3 Gravitational wave definition

Gravitational waves have a poor definition in terms of classical physics.

An excerpt from “NASA Space Place" which is simple but other public sites offer little or nothing in useful terms:

Gravitational waves are invisible. However, they are incredibly fast. They travel at the speed of light (186,000 miles per second).

Gravitational waves squeeze and stretch anything in their path as they pass by.

(Excerpt end)

Excerpt from the LIGO answer to "What are Gravitational Waves"

Gravitational waves are 'ripples' in space-time caused by some of the most violent and energetic processes in the Universe.
Albert Einstein predicted the existence of gravitational waves in 1916 in his general theory of relativity.
Einstein's mathematics showed that massive accelerating objects (such as neutron stars or black holes orbiting each other) would disrupt space-time in such a way that 'waves' of distorted space would radiate from the source (like the movement of waves away from a stone thrown into a pond).

Furthermore, these ripples would travel at the speed of light through the Universe, carrying with them information about their cataclysmic origins, as well as clues to the nature of gravity itself.

(Excerpt end)

Observation to the LIGO definition:

The definition by LIGO has no details to enable the construction of a device for a direct detection and measurement of this gravitational wave. This deviates from classical physics where gravity is a measurable force between 2 known masses.

LIGO claims “these ripples [are] carrying with them information about their cataclysmic origins” but there is no definition of how any such information can be carried in a wave defined only by a velocity.

Instead of extracting information from a wave, LIGO must make many assumptions having no evidence to justify the origin of their details.

The wave definition does not define:

a) the mechanism of its propagation, such as either longitudinal or transverse; it is certainly not electromagnetic radiation, or

b) The medium for this wave’s propagation, or

c) The velocity of propagation (just assumed to be c with no justification).

Space-time is only a 4-dimensional coordinate system defined by relativity for the special, moving observer and cannot be a medium for an undefined wave. There is no evidence for a supposed fabric of space, and a coordinate system can never be a physical thing.

LIGO built a system to detect an undefined wave having no defined medium for its propagation. LIGO expects this wave will squeeze and stretch the Earth, affecting the globe at multiple locations.
The multiple LIGO locations allow a triangulation of the source based on this minimal wave definition of only ‘squeeze and stretch’ and an assumed velocity.

LIGO is designed to detect a gravitational wave by monitoring Earth's crust for a disturbance which is analyzed and compared to computer generated templates assumed to match the expected results for this theoretical gravitational wave passing through the rigid crust of the Earth.

Just one test with an actual merger of two known bodies would have confirmed the system is working as designed, to the extent the result of the analysis was acceptable. This test was never executed. Without that crucial test and verification, LIGO had no basis for its operations. The first detection was a test, having no basis to grade its performance. LIGO had no apparent independent review of its performance, so all claims were accepted without question.
With no verification by an independent observation, any LIGO detection could have been a different wave like coming from a terrestrial source.

LIGO has never tested this system with a known gravitational wave to verify any of the assumptions.

Every GW detection by LIGO has no independent confirmation, to verify the details of the GW claim by LIGO.

20.4 Gravitational wave types

LIGO proposes several types of a Gravitational wave.

Excerpt from the LIGO site article Sources and Types of Gravitational Waves:

Continuous gravitational waves are thought to be produced by a single spinning massive object like a neutron star.

The next class of gravitational waves LIGO is hunting for is Compact Binary Inspiral gravitational waves. So far, all of the objects LIGO has detected fall into this category. Compact binary inspiral gravitational waves are produced by orbiting pairs of massive and dense ("compact") objects like white dwarf stars, black holes, and neutron stars. There are three subclasses of "compact binary" systems in this category of gravitational-wave generators:

- Binary Neutron Star (BNS)
- Binary Black Hole (BBH)
- Neutron Star-Black Hole Binary (NSBH)

Each binary pair creates a unique pattern of gravitational waves, but the mechanism of wave-generation is the same across all three. It is called "inspiral".
Inspiral occurs over millions of years as pairs of dense compact objects revolve around each other. As they orbit, they emit gravitational waves that carry away some of the system's orbital energy. As a result, over eons, the objects orbit closer and closer together. Unfortunately, moving closer causes them to orbit each other faster, which causes them to emit stronger gravitational waves, which causes them to lose more orbital energy, inch ever closer, orbit faster, lose more energy, move closer, orbit faster... etc. The objects are doomed, inescapably locked in a runaway accelerating spiraling embrace.

(Excerpt end)

LIGO also describes Stochastic Gravitational Waves and Burst Gravitational Waves.

Observation:

The inspiral type is the assumed source of the waves being detected by LIGO.

The inspiral scenario does not conform with Kepler’s laws of planetary motion, which conform with Newton’s force of gravity. When the two masses meet, in Kepler’s context, the result will be a mutual pivot around the center of gravity of the pair. Planets do not spiral into their star, but will always take an elliptical orbit around the system’s center of gravity. This behavior, consistent with Kepler, is also observed among the exoplanets.

There are numerous combinations of stars as a pair, called a binary. Alpha Centauri is a well-known triple, with a binary and the third orbiting around the binary. This system is stable, with none of them spiraling into others. The combination of frequent binary stars, and with a collision of 2 stars never being observed, should have prevented the inspiral scenario.

LIGO has no justification expecting their claimed pair of neutron stars, will do this proposed inspiral behavior. The most likely result is a binary, just like normal stars.

Perhaps the inspiral scenario arose when ignoring the real force of gravity, which affects both partners mutually. Space-time ignored the real force and tried to apply only the single active participant version, which uses only free-fall acceleration. Maybe in that distortion of gravity, the two will just accelerate into each other, as LIGO requires. The formation of a binary would not generate gravitational waves.

Since every LIGO description of a detection requires the wave originated in this inspiral behavior, LIGO is proposing a cause not justified by the well accepted Kepler's laws.

Again, LIGO must provide evidence for every claim they make, especially when not conforming to accepted physics, like Kepler's laws.

20.5 Earth tide

An earth tide is like an ocean tide, but in Earth's crust. A tide inn an ocean or in the crust cannot be explained by space-time. Only the force of gravity, as defined by Isaac Newton, can explain a tide.

Excerpt from Wikipedia:

Earth tide is the displacement of the solid earth's surface caused by the gravity of the Moon and Sun.
Its main component has meter-level amplitude at periods of about 12 hours and longer.

(Excerpt end)

There are 5 types of earth tide events in the LIGO history as the coincidental terrestrial source: Full Moon, New Moon, PeriGee, PeriHelion, and Moon-Jupiter alignment.
These 5 events will be referenced by a two-letter abbreviation:
FM, NM, PG, PH, MJ.

The Moon-Jupiter alignment event was a unique close celestial alignment with them and the Earth (in the solar system space they were far apart) on April 23, 2017.

The other 4 earth tide event types are well known to astronomers, needing no description here.

Though the MJ event happened only once, it is associated with several gravitational wave detections by LIGO, so MJ is in this list.

There is a frequent correlation between LIGO gravitational wave detections and the earth tide waves

A chart is provided later, plotting the differences between their respective dates.

This correlation will be noticeable in the historical data section. That observation alone is not sufficient for claims of causality.

20.6 LIGO Design

LIGO is the Laser Interferometer Gravitational-wave Observatory. There are several facilities, intentionally located around the world.

Excerpt from Wikipedia:

The LIGO concept built upon early work by many scientists to test a component of Albert Einstein's theory of general relativity, the existence of gravitational waves. Starting in the 1960s, American scientists including Joseph Weber, as well as Soviet scientists Mikhail Gertsenshtein and Vladislav Pustovoit, conceived of basic ideas and prototypes of laser interferometry, and in 1967 Rainer Weiss of MIT published an analysis of interferometer use and initiated the construction of a prototype with military funding, but it was terminated before it could become operational. Starting in 1968, Kip Thorne initiated theoretical efforts on gravitational waves and their sources at Caltech, and was convinced that gravitational wave detection would eventually succeed.

(Excerpt end)

20.7 LIGO Design Critique

LIGO has a design using a sophisticated hardware having extreme sensitivity for a very weak signal, with the expectation all data collected can be passed through complex software algorithms to find and declare the desired result. Its design is to capture all possible signals before looking for only the signal of interest. The alternative is a design for a specific signal; that was not the selection.

The software is the pivotal component. The LIGO system’s achievement is the claimed signal detection coming from the analysis of the data.

I see these steps in the LIGO design sequence. Quotes are usually from ligo.org site.

1. Define its objective.

From LIGO:

General Relativity predicts that a change in gravitational field will travel through the universe at the speed of light. It is exactly these changes in gravitational field that are gravitational waves.

My interpretation:

A change in a gravitational field occurs whenever a body's mass changes either through addition, like a merger, or through subtraction, like a fission or collision.
This event could occur anywhere in the universe, without the wave explicitly providing the many details of the wave's source, such as the types of the 2 participants in a claimed merger event, the mass of the fragments before or after the event.

2. Design an instrument that can detect that undefined wave. Only an event is described, but not how the event causes an undefined wave. The one certainty is the wave cannot be an electromagnetic wave because a black hole has no electric or magnetic fields to enable the propagation of such a wave.

From LIGO site:

LIGO's sensitivity and makes it capable of detecting changes in arm-length thousands of times smaller than a proton.
In a telescope, these [background] vibrations are unwelcome, but LIGO is designed to feel them.
LIGO's arms can readily magnify the smallest conceivable vibrations enough that they are measurable.

My interpretation:

Make the instruments so sensitive they can detect the smallest conceivable vibration or literally anything and everything.

3. Define how to find a wave.

From LIGO:

LIGO has been analyzing data since 2002 in an effort to detect and measure cosmic gravitational waves. LIGO's L-shaped detectors uses laser beams and mirrors in hopes of detecting changes in distance between its test masses as small as one-hundred-millionth of the diameter of a hydrogen atom. That change would indicate a wave's presence.

Gravitational waves have a finite speed and are expected to travel at the speed of light. This will induce a detection delay (up to about 10 milliseconds) between the two LIGO detectors. Using this delay and the delay between LIGO and its international partners will help pinpoint the sky location of the gravitational wave source. Multiple detectors also help sort out candidate gravitational wave events that are caused by local sources, like trees falling in the woods or even a technician dropping a hammer on site.

These events are clearly not gravitational waves but they might look like a gravitational wave in the collected data. If a candidate gravitational wave is observed at one detector but not the other within the light travel time between detectors, the candidate event is discarded.

(Excerpt end)

4. Define how to find the wave details in the data.

From LIGO:

Searches for gravitational-wave signals from the merger of compact binary systems were carried out by two independent search algorithms, named "PyCBC" and "GstLAL", that compare the observed data with the theoretical signal predicted by General Relativity using a technique called "matched filtering". In addition, another generic search algorithm, named "cWB", that does not assume a specific, theoretical model for the gravitational-wave signal, was also used. Improvements in these search algorithms and an extension of the search, in terms of the properties of the astrophysical objects being searched for, motivated the reanalysis of data from O1. Similarly, the application of a "data cleaning" procedure, to remove some of the detector noise and improve the sensitivity, has also motivated re-analysis of the O2 data.

Each search method produces a list of candidate events which are ranked in terms of their signal strength with respect to the detector's noise — a quantity called the "signal-to-noise-ratio" (SNR) — and their statistical significance, quantified by the false alarm rate (FAR), i.e. the rate at which one might expect such a candidate event to have occurred by chance, due simply to the noise characteristics of the detector data mimicking an actual gravitational-wave detection. By setting a FAR threshold of less than 1 per 30 days (about 12.2 per year) in at least one of the two matched-filter analysis algorithms, we restricted the list of candidate events and eliminated many candidate signals that are very likely to have been simply artefacts of the detector noise: within these candidates we found 11 events with a probability larger than 50% of having an astrophysical origin, rather than being instrumental noise. These candidates are labeled with the prefix 'GW' followed by the date of the detection (i.e. GW150914). The other candidates are considered as 'marginal' events, unlikely to be of astrophysical origin.

My interpretation:

Having designed instruments to record everything including background vibrations or noise, the signal to noise ratio is critical.

From Wikipedia:

In signal processing, a matched filter is obtained by correlating a known delayed signal, or template, with an unknown signal to detect the presence of the template in the unknown signal.

My interpretation:

Their analysis will inevitably find their "known" signal in this recorded noisy data, after adjusting templates and the algorithms using them.

The crucial aspect for LIGO is whether the evidence matches the claim, with absolute certainty. Any doubt requires thorough verification of this system relying on an indirect measurement. LIGO's detection of a hypothetical wave is akin to Russell's teapot scenario.

LIGO has a great responsibility to verify its incredible declaration.

They had to develop a “list of candidate events” for a reference. Detected events which are not passing all the tests were considered "marginal."

This analysis is complicated by having no experience with the reaction of Earth's crust to the hypothetical wave. The transition from hypothetical to a physical surface could cause many changes in a wave, including amplitude and wavelength, after an unknown transition delay between the two velocities: 1) the assumed, original propagation velocity of c while through an undefined medium, to 2) an unknown propagation velocity as a transverse wave through the solid crust.

Several LIGO personnel were interviewed about their experience with the first detection. YouTube had several videos, and some people were in more than one.

One reason why I believe no earlier detections occurred is the interviews never mentioned how this first detection to earn such publicity compared to any earlier detection, which was not valid for whatever reasons.

One stated something like: the number of days which will pass before the first wave is not known. That was honest and almost correct because there are no gravitational waves. The first detection would be the system responding to something else. The time before that first mistaken detection of the LIGO system was certainly unpredictable at the time when no signal had yet passed through all the components to result in a conclusion.

The first detection was on Monday September 14, 2013.
The description of the day implied the system had been off, suggesting it was not capturing data over the weekend.

The first wave detection was very few minutes after the start. For such a complex system, it is highly improbable everything works the very first time that the system is exercised.

LIGO site mentions no successes and failures during testing, before its initial success in 2015. They mention only equipment upgrades.

Perhaps the pressure for results would have been terribly oppressive to announce the system and all components have been thoroughly tested and verified.

Such a public announcement was done for the Hubble Space Telescope (which required an upgrade by astronauts, soon after its startup)), but I recall no initial fan-fare for LIGO.

The initial celebrated event detections involved claimed mergers of 2 black holes.

Immediate success under these conditions should have been unlikely.

The very first detection should have required extensive efforts at confirmation.
For example, for the first detection, it would be impossible for LIGO to distinguish among the 4 defined binary pairs, which one the 4 was the first 1. Since the wave carries no information, the only method to gain that knowledge is comparing the waves from known sources. LIGO should have known this limitation. Rather than ONLY after testing with a known binary merger could LIGO check if the entire system, from detection, through analysis, to wave source description, performs correctly.

Until detecting multiple sources of these undefined waves, there were no data to compare.
The combinations begin a necessary knowledge database.

Unless I missed it, LIGO was not honest about the learning process required at the start of their accumulation of unique events.

When having no accumulation of unique events, the first detection by this unique system had no basis for a conclusion, so the claimed description could not be based on actual data or experience.

In 2019, YouTube had several videos with LIGO personnel talking about GW150914, but in April, 2021, they could not be found.

LIGO Scientific Collaboration published a document online titled:
GW150914 - THE FIRST DIRECT DETECTION OF GRAVITATIONAL WAVES

The document does not indicate its date of publication. The header of the document:

On February 11, 2016, the LIGO Scientific Collaboration and Virgo Collaboration announced the first confirmed observation of gravitational waves from colliding black holes. The gravitational wave signals were observed by the LIGO's twin observatories on September 14, 2013. This confirms a key prediction of Einstein's theory of general relativity and provides the first direct evidence that black holes merge.
Below the 3:35 video is this paragraph:

On September 14, 2015, LIGO observed ripples in the fabric of spacetime. This video narrative tells the story of the science behind that important detection. (Credit: Caltech)

In the video, someone clearly (and proudly) states this was the first merger of 2 black holes.

That honesty means they had never detected another to compare and improve their analysis. One must question whether they really could detect what they claim, for all the initial detections. A history of data enables a better understanding.

LIGO was proud of their claims of firsts. Unfortunately, those claims required evidence to support every detail of their source of the waves being described.

If I proudly claimed my app, running on my cell phone with a special attachment, had detected a gravitational wave in M31 galaxy, of course everyone SHOULD immediately demand that I prove it.

LIGO has never provided evidence for any black hole mergers. Conveniently, they claim such a merger emits nothing detectable.

Every LIGO claim should have a clear disiclaimer, like:

No evidence is available, so all claims cannot be confirmed.

Without such a disclaimer everyone reading the LIGO claims cannot appreciate LIGO’s responsibility. Perhaps for the LIGO black hole merger, additional lines are appropriate, after the required lines above:

This type of merger leaves nothing measurable as evidence.

The description of the wave's source is uncertain, but based on the history of wave detections.

Something like those disclaimers would keep physicists honest in their interactions with the public. Instead, eventually the truth will be revealed and the repercussions will be severe and aggravated by the span of the deception.

20.9 LIGO Detection Details

A wave having a clear definition is the best scenario because so any claims of its detection should capable of an independent confirmation.
When having no history of detections with a verified source, it is impossible for LIGO to extract the many details of a claimed binary merger, from an undefined wave. LIGO has severe limitations on what it ca legitimately claim when lacking evidence

LIGO relies on this signal analysis, but this analysis has never been tested and verified with an event similar to that being described. A history enables differentiation among the scenarios. One must remember LIGO is the first making these claims, so every claim has no history to improve its accuracy.

The infamous chirp described by LIGO is often mentioned by LIGO personnel giving personal interviews. This chirp is NOT part of the detected wave or from the wave's source.

LIGO's design magnifies any disturbance many times. LIGO is proud of the extreme sensitivity in its interferometers.

Excerpt from LIGO:

The longer the arms of an interferometer, the smaller the measurements they can make. And having to measure a change in distance 10,000 times smaller than a proton means that LIGO has to be larger and more sensitive than any interferometer ever before constructed.

(Excerpt end)

The highest probability for this unverified system is if LIGO can really identify a 'chirp' with any earth tide wave, that ringing is from the LIGO design, not from the wave affecting the instruments. Any ringing claimed by LIGO from a wave detection is the edge of this surface wave's transitions at the detectors being extremely amplified by the system's design.

The other justification for knowing the chirp is from LIGO and not the gravitational wave is the coincidence between earth tide events and LIGO claiming detections.

For example, a perigee consistently causes a number of detections. The approach of the Moon with the rotation of the Earth cannot cause a ringing in the crust. The crust might jerk during its tidal pull, but it is unlikely an expanse of Earth's crust can sustain the ringing which is claimed.
Later, the entire set of LIGO detections will be presented.

LIGO must explain how every detection occurred during Earth's rotation while the crust was subject to a tidal pull. The tidal pull is substantially stronger than the weak signal LIGO is seeking.
The earth tide does not have to mimic any aspect of the theoretical gravitational wave. The earth tide must only trigger the LIGO analysis which reacts to a disturbance. The only possible result from the LIGO analysis is a GW, The subsequent step reviews the signal in some manner. If the template against the noise somehow matched whatever came from the Earth tide pull on the crust then the LIGO team can freely create its elaborate description for the event. The word chirp makes media interactions congenial.

Until LIGO presents evidence, every believer of LIGO's claims is deliberately kept unaware of the inherent uncertainty in the LIGO system and all its claims.

Nothing in the LIGO process has ever been verified. Each earth tide event triggers the LIGO analysis by software and results in an unverified merger description, lacking evidence to justify any assumptions driving the analysis is provided.

Until LIGO actually verifies the details of any detection all those details are invalid, including the chirp.

It is very difficult to grasp how the complexity of using tiny ripples detected at several widely spaced detectors can result in the very detailed conclusion from LIGO:

1) the type of each body, either black hole or neutron star,
2) the precise mass of each body,
3) a roughly described coordinate in the sky (the margin of error is undefined),
4) a roughly described distance to the event (the margin of error is undefined)
5) the remaining mass after the merger,
6) the spin of this remaining mass.

This is truly a major accomplishment (awarded the 2017 Nobel Prize in Physics) when the entire system (hardware and software) was never tested with even one such merger to verify whether any of the many details were correct.

Using the word incredulous for the widespread acceptance of LIGO’s claims by the community of astrophysicists, without question, is just an emotional reaction.

When LIGO’s claims affect astrophysics so deeply, scrutiny is certainly required.

20.10 Notable Detections

The 2 notable detections are the first, in 2015, and one in 2017, which earned LIGO a Nobel Prize, also in 2017.

20.10.1 Doubts of LIGO claims 1

Page from April 11, 2018 titled:

“Danish Group's Doubts That LIGO Discovered Gravitational Waves Resurface”

Excerpt:

A group of physicists in Denmark, which doubted last year whether American experiments to detect gravitational waves had actually confused noise for signal, has reared its head once more. The *New Scientist* reported earlier this week that the group, from the Niels Bohr Institute in Copenhagen, independently analysed the experimental data and found the results to be an “illusion” instead of the actual thing.

20.10.2 Doubts of LIGO claims 2

Physicist Sabine Hossenfelder mentioned LIGO in her 'backreaction” blog again, in another post over a year later.
Her blog entry on September 4, 2019 was titled: 'What’s up with LIGO?'

Her post included a link to a .de web page for its news story.

My web browser did a translation to English for this web page in Deutsch:

Its title in English: “Fake news from the universe”
You can either use this translation, read the original page using the link in the blog entry, to use your browser if you need a translation, or by another way.
Otherwise, the reader must decide whether the news story is an acceptable source. The lack of an appropriate reaction by LIGO suggests LIGO has no grounds to debate the story.

Excerpt from my browser's translation:

For two months now this new "window to the universe" is in operation and finds - nothing. Although there were not a few alerts from LIGO / VIRGO, but not a single signal that could have confirmed the large terrestrial or space telescopes. The astronomers are already slightly annoyed about the wasted observation time and ask questions. What's happening?

This surprising result should be a reason to take a closer look at the publications on gravitational wave observation over the last three years.

The statistical disturbances caused by random vibrations of the 3000 km distant LIGO laboratories had inexplicable correlations. Only the gravitational wave itself should be visible in both laboratories - with a corresponding delay due to the light propagation time. After ignoring the results of the Danish working group for a while, a group of eight scientists traveled to Copenhagen in August 2017 to discuss data analysis with their critics.

The gravitational wave researchers had to admit some mistakes, among other things, that the central figure in the journal Physical Review Letters was not created with the original data, but prepared for "illustrative purposes" - embarrassing for an article that was downloaded a hundred thousand times and was the basis of the Nobel Prize 2017, At the meeting in Copenhagen the photo of the blackboard was created. One of the leading LIGO scientists, Duncan Brown, promised to work with his colleagues for the correction - which has not happened to this day.

Meanwhile, Jackson's group has even proved that a so-called template, a theoretically calculated signal used for analysis, was subsequently replaced.

It is extremely remarkable that with this unprejudiced method none of the more than twenty detected gravitational wave signals could be reliably detected - except for the first signal GW150914 in September 2013. Now one could argue that this first signal provided proof and danger banned that the following signals were caused by arbitrary filtering of random noise.

Of course, this is still no evidence of manipulation, but it would be given the quite existing internal doubts certainly appropriate that LIGO makes its own investigations to more transparent.

However one evaluates these events, it remains the fact that after three more years of operation and meanwhile triple sensitivity of detectors GW150914 is still the strongest signal of all. A coincidence that gets stranger every day.

For many, therefore, the strongest evidence for gravitational waves is based on the August 2017 GW170817 signal discovered by LIGO and then confirmed by the Fermi (NASA) and Integral (ESA) gamma-ray / gamma-ray telescopes , but with very weak signal. at any rate, it was presented at the press conference.

In truth, it was the other way round: Fermi had sent the notification email first, and LIGO needed four hours to "predict" the sky position - which was consistent with the coordinates already known. The false impression that LIGO was the first one arose simply from the fact that after an explicit request by LIGO the subject line of the alert mail had been modified (see picture).

In addition to these inconsistencies, well-known experts contradict the interpretation that the signal comes from merging neutron stars. According to an author collet from nine renowned institutes, this is only possible through "extreme models" of the corresponding galaxies, while an Italian working group assigns the gamma-ray signal (or the afterglow) to a fusion of white dwarfs. But they can not send gravitational waves.

So there remain considerable doubts as to whether GW170817 was really confirmed by other telescopes or whether it was even a gravitational wave.

(End of excerpt from the translation)

Observation:

If this story is accurate, then it is truly a sensational revelation.

According to Sabine’s posts, LIGO has not responded to these questions being asked of their claims.

Perhaps, the reader will agree with this disturbing conclusion: This behavior involving such a widely proclaimed discovery is not proper science, which requires properly verified evidence for confirming a test’s results, and so LIGO has no credibility.

A comment about the unedited translation:

I suspect the words “danger banned” came from translating a word meaning “warning.”

20.10.3 Doubts of LIGO claims 3

Sabine Hossenfelder, a theoretical physicist at the Frankfurt Institute for Advanced Studies, wrote in her blog on November 2, 2019:
Have we really measured gravitational waves?

… the issue for me was that the collaboration didn’t make an effort helping others to reproduce their analysis. They also did not put out an official response, indeed have not done so until today. I thought then – and still think – this is entirely inappropriate of a scientific collaboration. It has not improved my opinion that whenever I raised the issue LIGO folks would tell me they have better things to do.

(Excerpt end)

Observation:

LIGO does not reply to concerns outside its group, even from this well-known physicist.

20.11 Correlation in 2019

Sometime in early 2019, I read an article describing LIGO was just detecting noise.
That is certainly not a worthwhile dismissal of LIGO. There must be a legitimate explanation for its claims because the count is accumulating, even if the cause is not what LIGO claims.

By May 2019, the number of detections was less than 20.

On May 8, 2019, I posted to a Facebook group, content below this title: LIGO events and the Moon Position
These were all the events in the LIGO history at the time of the post:

GW150914 NM-15-09-13 diff is +1 = 1 day after NM
GW151012 NM-15-10-12 diff is 0= same day as NM
GW151226 FM-15-12-25 diff is -1=1 day before FM
GW170104 PH170104 diff is 0 = same day as Perihelion
GW170608 FM-17-06-09 diff is -1= 1 day before FM
GW170729 NM-17-07-23 diff is +6= 6 days after FM
GW170809 FM-17-08-07 diff is +2= 2 days after FM
GW170814 PG-17-08-18 diff is -4= 4 days before Perigee
GW170817 PG-17-08-18 diff is -1= 1 day before Perigee
GW170818 PG-17-08-18 diff is 0= same day as Perigee
GW170823 NM-17-08-21 diff is +2= 2 days after NM
S190408 NM-19-04-05 diff is +3= 3 days after NM
S190412 PG-19-04-16 diff is -4 = 4 days before Perigee
S190421 FM-19-04-19 diff is +2= 2 days after FM
S190425 MJ-19-04-23 diff is +2 = 2 days after Moon+Jupiter conjunction
and is also 4 days after FM
S190503 NM-19-05-04 diff is -1= 1 day before NM

Clearly, these 17 GW detections in the early years of LIGO were closely associated with the earth tide events.

20.12 GW Predictions

The correlation between all LIGO gravitational wave detections and a terrestrial source might not be convincing evidence when presented alone.
However, predicting a future GW detection is a confirmation of causality. The astrophysical source should be random in the universe. A prediction can be made based on this known, predictable terrestrial source. Having that prediction confirmed by a LIGO gravitational wave detection while the earth tide was present confirms the causality. This random merger event is between 2 unusual bodies. Neither has been directly observed as noted in Section 4 (other concerns).

The gravitational waves are claimed to originate at great distances in the universe. They should not be predictable.

20.12.1 Predicting GW detections

a) Hypothesis Development

Historically LIGO reports detections within 2 days of an earth tide for more than half of the detections.
In observing run O3 there are usually additional detections outside of this narrower range.
In O1 and O2 9 of 11 were within 2 days; the other 2 were at 4 days.
In O3 with the increased sensitivity a small number of detections can be up to 7 or 8 days from that earth tide. In O3, 21 of the 41 merger detections were within 2 days.

The analysis reveals every earth tide event will always result in 1 or more LIGO wave detections.

More than half detections are within 2 days and there are usually a few more detections in the range of 3 to 5 days.

The simple hypothesis: LIGO will report a gravitational wave detection for the ripple in Earth’s crust from an earth tide event.

In observing run O3, the sequence of one earth tide event triggering more than one detection is observed multiple times.

The peak of each earth tide is known and predictable and the Earth rotates once per day so the influence is not present only at the moment of the peak alignment.
The alignment of Earth, Moon, and Sun for a full moon or a new moon takes a number of days for its effect to begin and end.
O3 exhibits a wider range than O1 and O2 for the span of days around the peak of earth tide events.
The Earth’s crust is solid, so the earth tide is different at the surface than on an ocean.
The ripple in the crust from an earth tide is not precisely predictable to a specific date for the LIGO detectors.
However, one should expect its ripple to span beyond just the date of its peak.

b) Prediction Development

Because of LIGO's inherent inconsistency which is increasing in the course of O3, the prediction could not be limited to only an exact date so a range is required. A range should be restricted enough to provide a valid prediction for a valid test.

On November 9, I noticed a full moon coming on November 12, so I gave my prediction to LIGO on the morning of November 10.

On November 9, LIGO Scientific Collaboration public Facebook page had a post about their new November 9 detection.
I selected this post for my prediction in a comment. No posts by the public are allowed in this Facebook group.

The LIGO Facebook page allows comments from the public but not posts.

I intentionally made the prediction for several explicit ranges of dates to prevent the easy dismissal of a '"One-time lucky guess."

At the moment that I made the prediction, the last O3 detection was on November 9.

c) Prediction

The prediction was given to LIGO Scientific Collaboration at 10 am my time or 16:xx UTC:

(Begin of text)

Predictions:
There will be LIGO detections between November 10 and 14, between November 21 and 25, between November 24 and 28.
There will be several other detections before and after these narrow ranges.
I was late with this prediction but detections were already reported on November 5 and 9.

Since LIGO began reporting detections it reports them in clumps with more in each clump in the O3 run (less in O1/O2).
For example, in 2017 August 14, 17, 18 had detections.

(End of text)

d) Test Results

These are the gravitational wave detections by LIGO after the prediction.
The format for each line:

LIGO detection ID, with a brief comment

S191110x, at 18:09:05 UTC or 2 hours after prediction

S191110af, at 23:10:59 or 7 hours after prediction

S191117j, or 3 days after the first range

S191120a, 1 day before the second range of dates in the prediction

S191120at, also for the second range

S191124be, also for the second range

S191129u, or 1 day after the start of the third range of dates in the prediction

e) Summary of Results

There were 2 detections within 7 hours of the prediction's first range of dates.

Another detection followed 7 days later.

The other two ranges were later in the month and also part of the prediction. Those 2 ranges of dates also had detections (4 of them) as predicted.

The prediction defined 3 ranges of dates for detections and all 3 predicted ranges had detections where 3 detections of the 6 were within 2 days which is the observed range for over half the detections.

Here is a comparison of the deviations between LIGO detections to the earth tides:

These 7 detections had these deviations in days from the triggering earth tide:
-2, -2, +5, -3, -3, +1, +3.

Each range had its clump of detections as expected in the prediction.

f) Conclusion from the Test Results

The prediction of wave detections within specific dates was confirmed by these LIGO detections and the hypothesis was validated by this simple test. Therefore:

LIGO declares gravitational wave detection for the ripple of an earth tide wave, making it possible to predict the wave detections.

The LIGO algorithm is not consistent with its detections in its history as demonstrated by 2 detections on a single day being reported twice in this small sample of only 7 detections. This sample is not a random distribution, but it contains the same behavior as found in the history of GW detections. There is no evidence for LIGO correctly counting its claimed astrophysical sources. One could suspect 2 detections on the same day is a software defect.

The distribution of LIGO detections is driven by the periodic earth tides.

20.10.2 Interaction with NSF

The National Science Foundation (NSF) provides resources to LIGO.

It is impossible to know the relationship between NSF and LIGO, especially regarding how LIGO publishes its GW detections (like: how is NSF informed? With which quality checks?).

20.10.2.1 Interaction with NSF - First

On November 23, 2019, I sent this email to the NSF, to their transparency office.

(Email begin)

Hi,
I am a retired electrical engineer who is concerned about the accountability of the LIGO project to NSF,

On November 10 I made a prediction LIGO would report several detections around the span of November 10 to 14 and also during two other 5 day spans later in November.

As of today 11/23 LIGO has 3 detections after my prediction for the first span and 2 detections for the second span.

I made my prediction in a comment to a post in the LIGO Facebook page.

Before I entered the comment, I verified GraceDB site had no events after November 9.
The last event was S191109d on November 9 at 01:07:46 UTC

Here is the post in LIGO Scientific Collaboration facebook group (posted November 9 at 1 pm):

So November has been quite a month already for @LIGO @ego_virgo and #GravitationalWaves - and we're only 9 days in so far!!.... What's still to come in the next 3 weeks? Watch this space(-time)! (And don't forget you can follow our #GravitationalWaves alerts on #Chirp)

my comment to LIGO SC was dated on November 10 at 10 am:

Predictions:
There will be LIGO detections between November 10 and 14, between November 21 and 25, between November 24 and 28.
There will be several other detections before and after these narrow ranges. I was late with this prediction but detections were already reported on November 5 and 9.

Since LIGO began reporting detections it reports them in clumps with more in each clump in the O3 run (less in O1/O2).
For example in 2017 August 14, 17, 18 had detections.

end predictions

My prediction results:

This is what happened after I presented my prediction to LIGO.

GraceDB reported the following events:

S191110x on November 10 at 18:09:05 UTC - about 2 hours after my prediction at about 16:xx:xx UTC.
S191110af on November 10 at 23:10:59 UTC - about 7 hours after my prediction.

I expected LIGO to get multiple detections centered on the date November 12 simply because there was a full moon on that date!

The 2 detections on November 10 were enough to confirm the prediction for Nov 10 to 14.

On November 10 I had the confidence to predict LIGO detections in 3 different spans of 5 days each.
My prediction included two other 5-day spans later in November.
The first subsequent range is for the perigee on November 23 and the other range is for the new moon on November 26.

I expect those predictions to be confirmed as well.
As of today 11/23, LIGO reported S191117j which was expected for the 11-14 range.
LIGO also reported S191120aj and S19120at; both were expected for the Nov 21-25 range.

The following statistics were my simple basis for a prediction by using the distribution of days for all previous LIGO detections to recognize the pattern.

=== stats
There are the 5 celestial events which LIGO detects: Full Moon, New Moon, Perigee, Perihelion, and a unique Moon-Jupiter conjunction.
As the Earth rotates these events cause a wave in Earth's crust, called an earth tide.

All wave detections by LIGO are analyzed to determine the two bodies involved in the merger causing the wave and the approximate location in the sky for this merger. Probabilities are assigned to the possible combinations. The 2 candidates are a black hole or neutron star. The merger will be one of the 4 combinations of the 2 candidates. In some cases the probabilities are not high enough to be considered 'robust' but some events meet the robust criteria set by LIGO.

A wave detection on August 17, 2017 was robust and apparently confirmed so LIGO was awarded the 2017 Nobel Prize in Physics for this achievement.

However all LIGO detections are associated with these 5 celestial events.
The following includes statistics of the events.

When one of these 5 events resulted in a wave detection by LIGO in the range of 2 days before to 2 days after that result will be counted as DW2 (detection within 2 days).

When one of these 5 events resulted in a wave detection by LIGO in the range of 7 days before to 2 days after that result will be counted as DW7 (detection within 7 days).

When one of these 5 events resulted in a gravitational wave detection with an assigned merger source that result will be counted as DGW (detection of Gravitational Wave).

These are the distributions of LIGO wave detections, with and without an identified merger source.
GraceDB lists all the O3 wave detections while Wikipedia list all the gravitational wave detections (with an assigned source) since 2013.

Each terrestrial source is listed with its counts.

Full Moon =10x
DW2 = 13x
DW7 = 21x
DGW = 15x

New Moon = 11x
DW2 = 15x
DW7 = 20x
DGW = 19x

Perigee = 5x
DW2 = 6x
DW7 = 6x
DGW = 6x

(Note: there were more perigee events than 5 but others coincided with a FM or NM so the overlap detections were counted with the FM or NM).

Perihelion = 1x
DW2 = 1x
DW7 = 1x
DGW = 1x

Moon-Jupiter conjunction = 1x
DW2 = 1x
DW7 = 2x
DGW = 2x

Conclusions:

a) Each perihelion, or Moon-Jupiter conjunction has resulted in a claim of a GW with an assigned merger as the distant source.

b) Each perigee has resulted in 1 or 2 claims of a GW with an assigned merger as the distant source.

c) Each full moon or new moon has resulted in 1 or more claims of a GW with an assigned merger as the distant source.

=== stats end

These are not just coincidences.
LIGO is detecting the wave from a terrestrial source and not from a distant astrophysical source as claimed.

They must verify their claimed distant source.
On November 10 I predicted a gravitational wave detection based on a full moon and 2 detections followed in the next 7 hours, confirming a wave from a moon event is detected as a gravitational wave by LIGO.
The above statistics indicate an incredible coincidence if another source is claimed.

The above list includes all LIGO detections. There are no detections without an associated earth tide event.
It should be clear to everyone these are not random coincidences.
LIGO reports detections during an earth tide's ripple in the crust while the Earth continues its rotation. Because of this rotation the detections are rarely limited to the date of the peak of the earth tide.
My prediction's expectation:
I expected any combination of 0, +/- 1, +/- 2 (Nov 10-14) around this full moon as well as others outside the 5-day range.

The observed results after my prediction:

There were 2 detections in the predicted span from Nov 10 to 14 (inclusive),
and also there were other detections slightly outside this span (on Nov 5, 9, 17).

There were 5 detections in this predicted clump (the word in my prediction) around a defined 5-day span.

The basis for my confidence is LIGO triggers its detections on a predictable terrestrial source.
These sets of dates in the prediction were selected based on the assumption LIGO will continue to report detections consistent with its history. The distribution for each earth tide is not consistent.
It is impossible to make precise predictions for specific dates because the LIGO design uses software to find a template in the signal from an extremely sensitive system. The software's conclusion that this signal has the template is not predictable but over a number of days of Earth's rotation usually one or more detections are reported. The terrestrial source does not have to mimic a gravitational wave; it must only trigger the analysis. The earth tide wave is only a trigger to invoke the software. LIGO does no direct measurement but relies on software for analysis. When triggered the only possible conclusion is an inspiral even if an earth tide was the trigger.
LIGO is not detecting gravitational waves when triggered by a terrestrial source.
It is impossible to predict an event from a anywhere in the universe within a specific span of only a few days. My goal was more than one detection in this clump and that was achieved.
One is easily assigned to chance but multiple detections (2 on the same day and within the specified span) in a defined 5-day range are more awkward for only chance. There are two later spans in the prediction for November.
I expect an argument stating my prediction is well within statistical probabilities. My counter is I have an identified source for the predicted detection while LIGO has no independent confirmation to validate their detection claim. I must point out LIGO detections should have a random distribution but clearly it is not random when there are readily observed patterns (which I have documented) in the dates. If someone claims my prediction with a valid source is explained by probabilities then LIGO must explain why its unconfirmed detections are incredibly not random.

These claims are not questioned though they must be.

This prediction demonstrates LIGO is not detecting what it claims. It should have been impossible to predict detections within any specified range of dates. I was successful with a 5-day range.

LIGO is not detecting gravitational waves.

I consider my prediction for a clump of detections for the first span of Nov 10-14, and for the second span, confirmed.

I predicted the detections on November 10 would result from the full moon on November 12. Now LIGO should provide evidence for the claimed merger. I have confirmed evidence for my claim.

NSF has funded LIGO but they must confirm they are detecting real gravitational waves.

By my prediction of gravitational waves being confirmed within 7 hours, I verified my hypothesis LIGO expects only gravitational waves can be detected with their system.

They did not expect a wave in the crust caused by a full moon and Earth's rotation could pass their filter match algorithm. It does pass.

I believe only NSF can request LIGO to confirm their claims of wave detections.
I posted all the above statistics to the LIGO S.C. page with no response.
This expected because they are not accountable to me.
Perhaps NSF will hold LIGO accountable.

Thank you for considering this issue,

David Michalets

(Email end)

20.10.2.2 Interaction with NSF - Second

On November 24, 2019, I sent this email to the NSF

(Email start)

Hi,

Yesterday November 23 I sent an email with the historical data of LIGO detections.
This email is a follow up, so the first was not too large.

On November 10 I made a prediction LIGO would report several detections around the span of November 10 to 14 and also during two other 5 day spans later in November.

As of today 11/24 LIGO had 3 detections after my prediction for the first span and 3 detections for the second span.

I made my prediction in a comment to a post in the LIGO Facebook page. I followed with a comment my prediction was confirmed - verifying I can make predictions for LIGO based on lunar events.

The reason for this second email:
NSF should know I am not alone with concerns about LIGO.

Rather than including links which can be rejected as spam, I will include searches for the references.

The popular physicist Sabine Hossenfelder has brought LIGO to the attention of the international community.

Web search: "'What's up with LIGO?"
gets her BackReaction blog post on September 4, 2019

In her post she included a link to a .de web page.

Google Chrome does a translation for me, for this Deutsch web page.
Its title in English: 'Fake news from the universe'

Here are excerpts in English.

From my browser's translation: ===
'
For two months now this new "window to the universe" is in operation and finds - nothing.
Although there were not a few alerts from LIGO / VIRGO, but not a single signal that could

have confirmed the large terrestrial or space telescopes. The astronomers are already slightly annoyed about the wasted observation time and ask questions. What's happening?

This surprising result should be a reason to take a closer look at the publications on gravitational wave observation over the last three years.

The statistical disturbances caused by random vibrations of the 3000 km distant LIGO laboratories had inexplicable correlations. Only the gravitational wave itself should be visible in both laboratories - with a corresponding delay due to the light propagation time. After ignoring the results of the Danish working group for a while, a group of eight scientists traveled to Copenhagen in August 2017 to discuss data analysis with their critics.

The gravitational wave researchers had to admit some mistakes, among other things, that the central figure in the journal Physical Review Letters was not created with the original data, but prepared for "illustrative purposes" - embarrassing for an article that was downloaded a hundred thousand times and was the basis of the Nobel Prize 2017, At the meeting in Copenhagen the photo of the blackboard was created. One of the leading LIGO scientists, Duncan Brown, promised to work with his colleagues for the correction - which has not happened to this day.

Meanwhile, Jackson's group has even proved that a so-called template, a theoretically calculated signal used for analysis, was subsequently replaced.

It is extremely remarkable that with this unprejudiced method none of the more than twenty detected gravitational wave signals could be reliably detected - except for the first signal GW150914 in September 2013. Now one could argue that this first signal provided proof and danger banned that the following signals were caused by arbitrary filtering of random noise.

Of course, this is still no evidence of manipulation, but it would be given the quite existing internal doubts certainly appropriate that LIGO makes its own investigations to more transparent.

However one evaluates these events, it remains the fact that after three more years of operation and meanwhile triple sensitivity of detectors GW150914 is still the strongest signal of all. A coincidence that gets stranger every day.

For many, therefore, the strongest evidence for gravitational waves is based on the August 2017 GW170817 signal discovered by LIGO and then confirmed by the Fermi (NASA) and Integral (ESA) gamma-ray / gamma-ray telescopes , but with very weak signal. at any rate, it was presented at the press conference.

In truth, it was the other way round: Fermi had sent the notification email first, and LIGO needed four hours to "predict" the sky position - which was consistent with the coordinates already known. The false impression that LIGO was the first one arose simply from the fact that after an explicit request by LIGO the subject line of the alert mail had been modified (see picture).

In addition to these inconsistencies, well-known experts contradict the interpretation that the signal comes from merging neutron stars. According to an author collet from nine renowned institutes, this is only possible through "extreme models" of the corresponding galaxies, while an Italian working group assigns the gamma-ray signal (or the afterglow) to a fusion of white dwarfs. But they can not send gravitational waves.

So there remain considerable doubts as to whether GW170817 was really confirmed by other telescopes or whether it was even a gravitational wave.

=== End of my excerpts from browser's translation

This event GW170817 and its claimed confirmation were the basis for LIGO getting the 2017 Nobel Prize in Physics.
This apparent data manipulation is not proper science.

Since my confirmed prediction was done using the LIGO facebook page, I am suspicious data manipulation continues.

Based on the LIGO history there should have been a number gravitational wave (GW) detections, with assigned binaries, associated with the dates in my prediction. There have been no GW detections with identified binaries since November 9, the day before my prediction. I consider this "suspicious."
With a confirmed prediction, LIGO could be avoiding a problem discussing the validity of any claimed GW detections.

YouTube: "Have we really measured gravitational waves?"

This video about LIGO is from physicist Sabine Hossenfelder.

I believe only NSF can request LIGO to confirm their claims of wave detections.
I posted the predictions and statistics to the LIGO S.C. page with no response.
This is expected because LIGO is not accountable to me.
Perhaps NSF will hold LIGO accountable for its claims.

Thank you for considering this issue,

David Michalets

(Email end)

20.10.2.3 Interaction with NSF - Third

On December 9, 2019, I received this brief email from the NSF Office of Inspector General:

(Email start)

Mr. Michalets,

Please consider this an acknowledgment of your request.

National Science Foundation
Office of Inspector General

(Email end)

20.10.2.4 Interaction with NSF - Fourth

On December 16, 2019, I received an email from the Program Director for Gravitational Physics

It began with:

Dear Mr. David Michalets

Thank you for your interest in NSF's Gravitational Physics programs and, in particular, LIGO.

The email continued the claims of 2015 and 2017 detections.

That generic stuff is not relevant here.

20.10.2.5 Interaction with NSF - Finish

I am glad NSF OIG had the courtesy to acknowledge my request.

The NSF probably has little incentive to intervene in LIGO operations.

Over 16 months later, in April, 2021, I noticed the items described in section Actions 2021. I cannot confirm this, but I suspect some of those actions taken by LIGO were in response to my request to NSF OIG.

20.11 Actions in 2021

Sometime around early 2021, the history of LIGO was changed.

a) Detections dated earlier in runs O1 and O2 were added,

b) Detections in late 2019 were given the Retracted status.

c) LIGO SC Facebook posts in November and December of 2019 were deleted.

The deleted posts had contained my comments including my predictions, and the retracted events were some of those predicted before reported.

20.12 LIGO GW History

The historical data are here for a convenient reference. Some background is provided to establish the context for the data set.

All of the LIGO gravitational wave detections are listed through March 2021, along with their associated earth tide events. This list uses the Wikipedia data as of May 8, 2021.

The LIGO GW detections can begin 1 or more days before the peak of the earth tide event because:

a) The Earth is rotating with no hesitation,

b) Earth's crust is rigid but is being disturbed by a change in the distance to the Moon and/or to the Sun.

c) Any change in distance takes many days to complete,

d) Any change in a celestial alignment takes many days to complete.

The Moon takes roughly 29 days to complete 1 orbit. During each orbit, there will be 1 full Moon, 1 New Moon, and 1 perigee. The number of days between these events varies during each orbit, due to the elliptical path.

The dates of the Moon phases are noted in UTC date/time, not a local time, because LIGO reports its events using UTC.

Roughly by April 2019 at the start of observing run O3, LIGO had significantly increased the sensitivity of the system.

The claim by LIGO was this upgrade increased the range of possible distances to the events.

The history reveals more events were being recorded for a similar triggering real event.

Even through LIGO upgrades, all detections follow the timing of the earth tides.

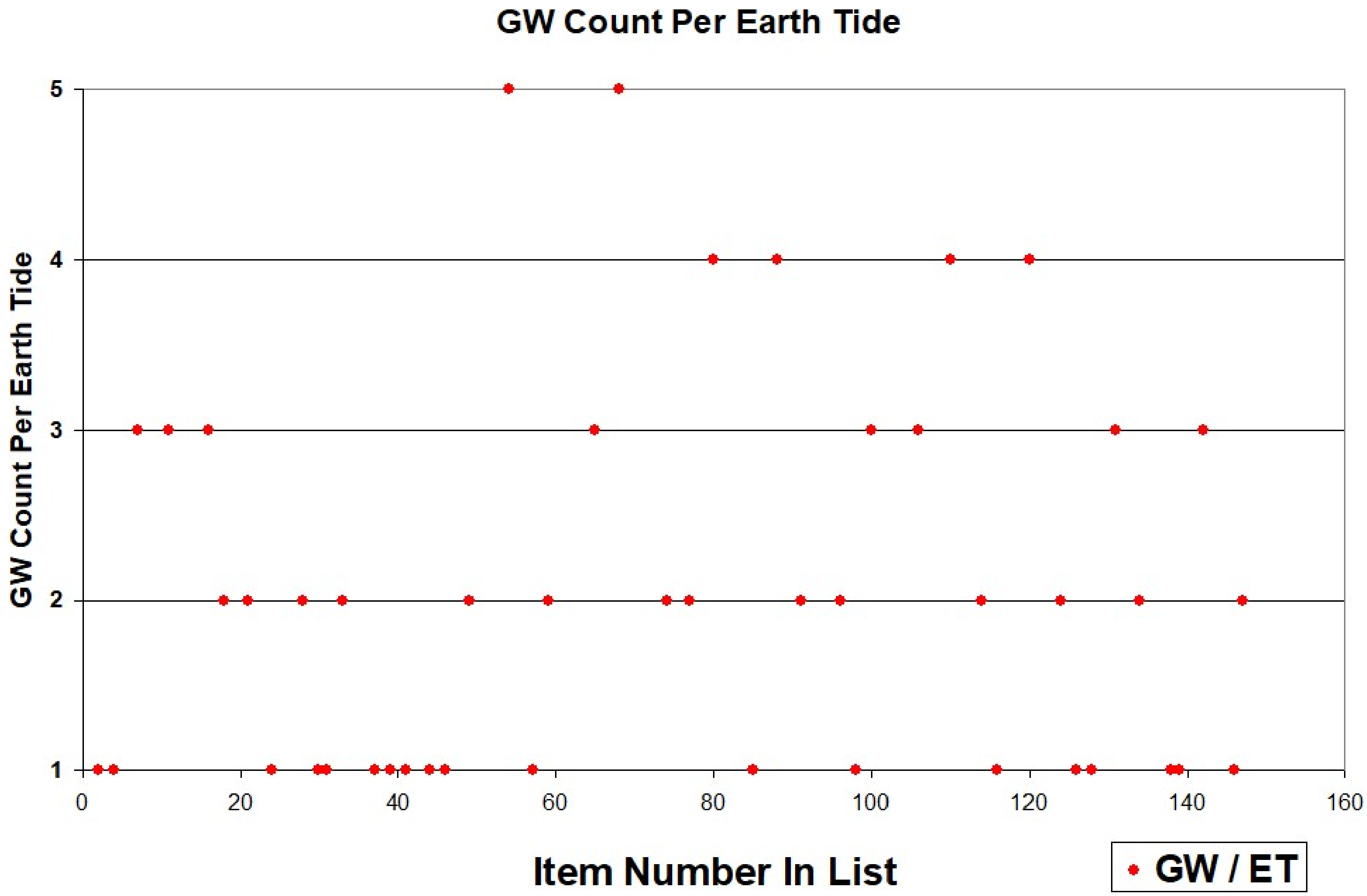
All the date entries use the same 6-digit date format of YYMMDD (where YY is from the year as 20YY), where the detection will have one or two letters before the date and rarely more letters after the date. The earth tide dates have two letters before the date.
2.2.
For example, NM150913 means New Moon on 2015, September 13.

To distinguish between the 3 observing runs: 2015 was O1; 2017 was O2, and 2019 was in O3; 2020 has continued as part of O3.

LIGO's design magnifies any disturbance many times; LIGO is proud of this sensitivity.
If LIGO can really identify a `chirp' with any full moon or new moon passing overhead, that ringing is from the LIGO design not from the earth tide wave. LIGO using unverified software claims it found the chirp but with no independent observational evidence as verification of the actual merger event.

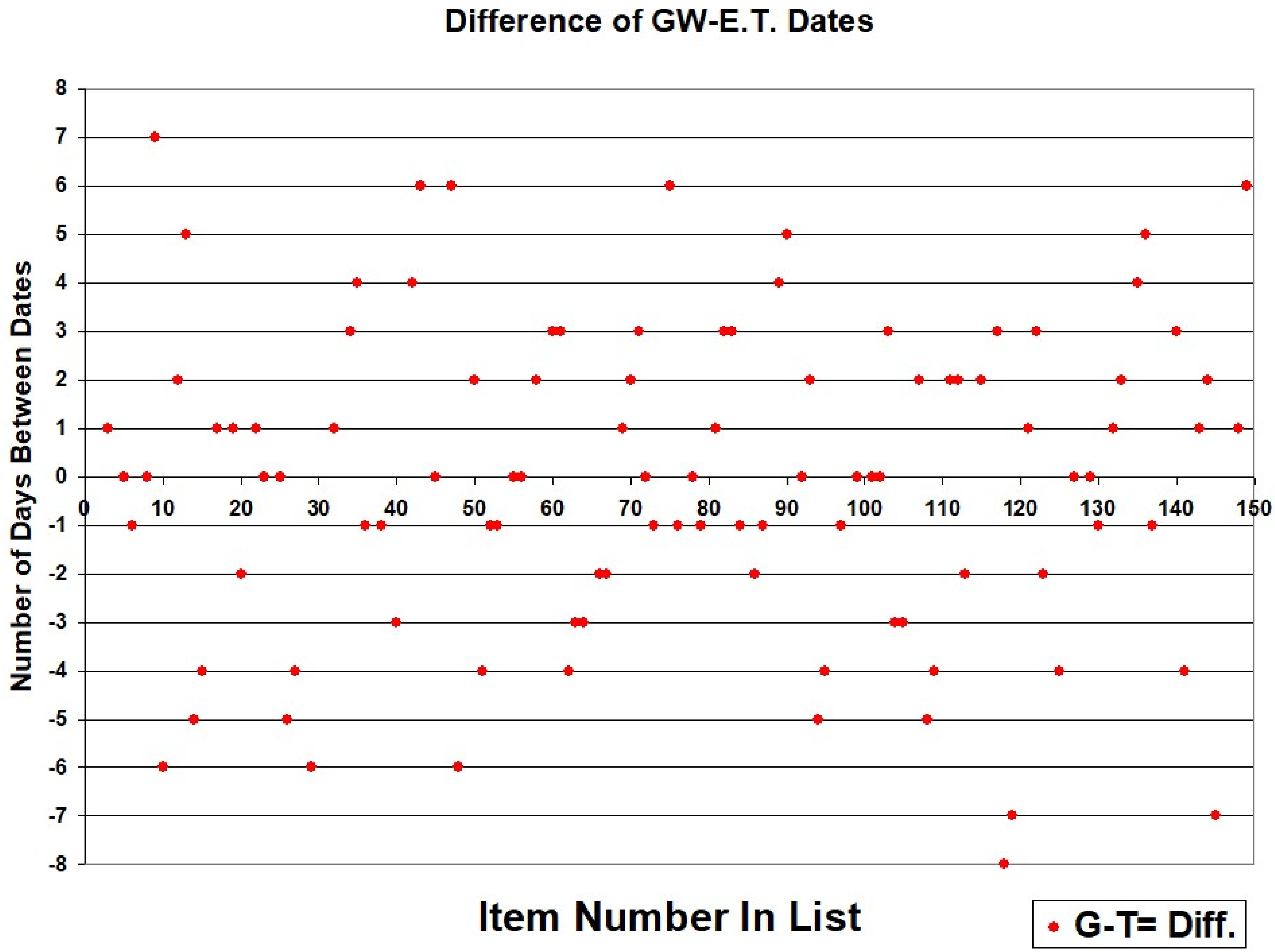
20.12.1 GW Detections per Earth Tide event

The number of GW detections reported for each earth tide event associated with them is plotted in the following chart.



20.12.2 GW Differences in days between a detection and its associated Earth Tide event

The number of GW detections reported for each earth tide event associated with them is plotted in the following chart.



20.12.3 LIGO History of its GW detections and the binary pair claimed as its astrophysical source.
The date of an associated Earth Tide event is mixed

This table is in chronological order.

The start of each line is the date of the event.

After the 6-character date, the event is identified by either ET= for an Earth Tide event (the date is its peak), or GW= for a Gravitational Wave detection event.

A blank line is between the associations.

(Start of history)

Date Event
150913 ET= New Moon, 1x GW
150914 GW= GW150914, 1 day after NM; BH+BH

150928 ET= Perigee, 1x GW
150928 GW= 150928, same day as PG; NS+NS

151011 GW= 151011 1 day before NM; BH+BH
151012 ET= New Moon, 3x GW
151012 GW= GW151012. same day as NM; BH+BH
151019 GW= 151019, 7 days after NM

151205 GW= 151205, 6 days before NM; BH+BH
151211 ET= New Moon, 4x GW
151213 GW= 151213, 2 days after NM; BH+BH
151216 GW= 151216A, 5 days after NM; BH+BH
151216 GW= 151216B, 5 days before PG; BH+BH
151217 GW= 151217, 4 days before PG; BH+BH
151221 ET= Perigee, 2x GW
151222 GW= 151222, 4 days before FM; BH+BH
151225 ET= Full Moon, 1x GW
151226 GW= GW151226, 1 day after FM; BH+BH

151231 GW= 151231, 2 days before PH; no pair
160102 ET= Perihelion, 2x GW
160103 GW= 160103, 1 day after PH; BH+BH

170104 ET=Perihelion; 1x GW
170104 GW= GW170104, same day as PH; BH+BH

170201 GW= 170201, 5 days before PG; BH+BH
170202 GW= 170202, 4 days before PG; BH+BH
170206 ET= Perigee, 3x GW

170220 GW= 170220, 6 days before NM; BH+BH
170226 ET= New Moon, 1x GW
170303 ET= Perigee, 1x GW
170304 GW= 170304, 1 day after PG; BH+BH
170330 ET= Perigee, 2x GW
170402 GW= 170402, 3 days after PG; BH+BH
170403 GW= 170403, 4 days after PG; BH+BH

170425 GW= 170425, 1 day before NM; BH+BH
170426 ET= New Moon, 1x GW

170608 GW= GW170608, 1 day before FM; BH+BH
170609 ET= Full Moon, 1x GW

170620 GW= 170620, 3 days before Perigee; BH+BH
170623 ET = Perigee, 3x GW
170627 GW= 170627, 4 days after Perigee; BH+BH

170629 GW= 170629, 6 days after Perigee; BH+BH
170721 ET= Perigee, 1x GW
170721 GW= 170721, same day as Perigee; BH+BH

170723 ET= Full Moon, 1x GW
170729 GW= GW170729, 6 days after Full Moon; BH+BH

17801 GW= 170801, 6 days before Full Moon; BH+BH
17807 ET= Full Moon, 3x GW
170809 GW= GW170809, 2 days after Full Moon; BH+BH

170814 GW= GW170814, 4 days before Perigee; BH+BH
170817 GW= GW170817, 1 day before Perigee; BH+BH
170817 GW= 170817A, 1 day before Perigee; BH+BH
170818 ET= Perigee,3x GW
170818 GW= GW170818, same day as Perigee; BH+BH
170818 GW= 170818, same day as Perigee; BH+BH

170821 ET= New Moon, 1x GW
170823 GW= GW170823, 2 days after New Moon; BH+BH

190405 ET= New Moon, 2x GW
190408 GW= GW190408ar, 3 days after New Moon; BH+BH
190408 GW= GW190408_ 181802, 3 days after New Moon; BH+BH

190412 GW= GW190412, 4 days before Perigee; BH+BH
190413 GW= GW190413_ 052954, 3 days before Perigee; BH+BH
190413 GW= GW190413_ 134308, 3 days before Perigee; BH+BH
190416 ET= Perigee, 3x GW

190421 GW= GW190421_ 213856, 2 days before Moon+Jupiter; BH+BH
190421 GW= S190421ar, 2 days before Moon+Jupiter; BH+BH
190423 ET= Moon+Jupiter, 5x GW
190424 GW= S190424_ 180648, 1 day after Moon+Jupiter; BH+BH
190425 GW= GW190425, 2 days after Moon+Jupiter; BH+BH
190426 GW= S190426c, 3 days after Moon+Jupiter; BH+BH

190503 GW= S190503bf, 1 day before New Moon; BH+BH
190504 ET= New Moon, 2x GW
190510 GW= S190510g, 6 days after New Moon; BH+BH

190512 GW= S190512at, 1 day before Perigee; BH+BH
190513 ET= Perigee, 2x GW
190513 GW= S190513bm, same day as Perigee; BH+BH

190517 GW= S190517h, 1 day before Full Moon; BH+BH
190518 ET= Full Moon, 4x GW
190519 GW= S190519bj, 1 day after Full Moon; BH+BH
190520 GW= S190521g, 3 days after Full Moon; BH+BH
190521 GW= S190521r, 3 days after Full Moon; BH+BH

190602 GW= S190602aq, 1 day before New Moon; BH+BH
190603 ET= New Moon, 1x GW

190630 GW= S190630ag, 2 days before Full Moon; BH+BH
190701 GW= S190701ah, 1 day before Full Moon; BH+BH
190702 ET= Full Moon, 4x GW
190706 GW= S190706ai, 4 days after Full Moon; BH+BH
190707 GW= S190707q, 5 days after Full Moon; BH+BH

190718 ET = Full Moon, 2x GW
190718 GW= S190718y, same day as Full Moon; BH+BH
190720 GW= S190720a, 2 days after Full Moon; BH+BH

190727 GW= S190727h, 5 days before New Moon; BH+BH
190728 GW= S190728q, 4 days before New Moon; BH+BH
190801 ET= New Moon, 2x GW
170802 ET= Perigee, 0x GW (1 day after NM)

190814 GW= S190814bv, 1 day before Full Moon; BH+BH
190815 ET= Full Moon, 1x GW

190828 GW= S190828j, 2 days before Perigee; BH+BH
190828 GW= S190828l, 2 days before Perigee; BH+BH
190830 ET= Perigee, 3x GW
190901 GW= S190901ap, 1 day after Perigee; BH+BH

190910 GW= S190910d, 3 days before Full Moon; BH+BH
190910 GW= S191910h, 3 days before Full Moon; BH+BH
190913 ET= Full Moon, 3x GW
190915 GW= S190915ak, 2 days after Full Moon; BH+BH

190923 GW= S190923y, 5 days before Perigee; BH+BH
190924 GW= S190924h, 4 days before Perigee; BH+BH
190928, ET= Perigee, 3x GW
190930 GW= S190930s, 2 days after Perigee; BH+BH
190930 GW= S190930t, 2 days after Perigee; BH+BH

191105 GW= S191105e, 2 days before Perigee; BH+BH
191107, ET= Perigee, 2x GW
191109 GW= S191109d, 2 days after Perigee; BH+BH

191126 ET= New Moon, 1x GW
191129 GW= S191129u, 3 days after New Moon; BH+BH

191204 GW= S191204r, 8 days before Full Moon; BH+BH
191205 GW= S191205ah, 7 days before Full Moon; BH+BH
191212 ET= Full Moon, 4x GW
191213 GW= S191213g, 1 day after Full Moon; BH+BH
191215 GW= S191215w, 3 days after Full Moon; BH+BH

191216 GW= S191216ap, 2 days before Perigee; BH+BH
191218 ET= Perigee, 1x GW

191222 GW= S191222n, 4 days before Full Moon; BH+BH
191226 ET= Full Moon, 1x GW

200105 ET= Perihelion, 1x GW
200105 GW= S200105ae, same day as Perihelion; BH+BH

200112 GW= S200112r, 1 day before Perigee; BH+BH
200113   ET= Perigee, 3x GW
200114 GW= S200114f, 1 day after Perigee; BH+BH
200115 GW= S200115j, 2 days after Perigee; BH+BH

220124 ET= New Moon, 4x GW
200128 GW= S200128d, 4 days after New Moon; BH+BH
200129 GW= S200129m, 5 days after New Moon; BH+BH

200208 GW= S200208q, 1 day before Full Moon; BH+BH
200209 ET= Full Moon, 1x GW

200210 ET= Perigee, 1x GW
200213 GW= S200213t, 3 days after Perigee; BH+BH

200219 GW= S200219ac, 4 days before New Moon; BH+BH
200223 ET= New Moon, 3x GW
200224 GW= S200224ca, 1 day after New Moon; BH+BH
200225 GW= S200225q, 2 days after New Moon; BH+BH

200302 GW= S200302c, 7 days before Full Moon; BH+BH
200309 ET= Full Moon, 1x GW

200310 ET= Perigee, 2x GW
200311 GW= S200311bg, 1 day after Perigee; BH+BH
200316 GW= S200316bj, 6 days after Perigee; BH+BH

(End of history)

20.12.4 Summary of LIGO history

Of the 97 detections through March 2021, these were the distribution of the days from an earth tide peak date:

0 days = 9 GW,
1d= 26,
2d = 21,
3d = 13,
4d = 11,
5d = 6,
6d = 7,
7d = 3,
8d = 1
This shows 69 out of 97 were within 3 days of an earth tide date.

Clearly, there is a coincidence between the claimed astrophysical events and the predictable terrestrial events. However, LIGO is very sensitive, so its detections are inconsistent in their distribution. Many of the detections having a larger difference in dates were one of several for the same earth tide event.

There were 47 earth tide events triggering 97 GW detections in this history.

One perigee (on 170802) was 1 day after a New Moon, so the New Moon was given credit for the 2 detections reported before the New Moon. Though this perigee was assigned no GW, it remains in the list, because the perigee should be noted in the sequence. Those 2 events were more than 4 days early but the timing of the imminent perigee would have increased the tidal effect of the New Moon.

Here is the count of the respective earth tide events in this data set:

Full Moon = 19,
New Moon = 24,
Perigee = 19,
Perihelion = 3,
Moon+Jupiter alignment = 1.

Here is the distribution of GW detections to their earth tide trigger:

Full Moon = 19,
New Moon = 24,
Perigee = 38,
Perihelion = 4,
Moon+Jupiter alignment = 5.

Though there is only 1 perigee with the FM and NM in each lunar cycle, the perigee appears to affect Earth's crust more than the other earth tides.

The following observation compares the deviation spread in the history of GW detections over the 3 observing runs.

Observing runs O1 and O2 had no GW beyond 4 days of an earth tide peak, among the original events. (In 2021 several weak events were added and they have a wider difference.)Only one perigee, on 170623, resulted in 3 detections. After the upgrade in 2019 beginning run O3, the spread within a cluster became wider. Detections on consecutive days became more frequent. These changes in distribution are easily explained by the terrestrial source association. With an unpredictable astrophysical source, the distribution should remain random. This non-randomness should be an alert of a problem in the system, but the LIGO results are never questioned, despite no evidence. With run O3, LIGO was not detecting more of the distant mergers as claimed but LIGO actually detected more gravitational waves from the same earth tide as the terrestrial source spanning more than one day.

For clarity, all LIGO detections from Wikipedia are listed. Beginning with run O3 in 2019, LIGO posted many (all?) of their detections to their GRACEDB site, including those whose analysis failed to obtain the merger pair. As a result, some wave events recorded in GRACEDB are not posted in Wikipedia where probabilities are assigned to the various merger combinations. This analysis covers all LIGO GW detections from Wikipedia, not from other sources.

Perhaps the binary pair was unnecessary, at the end of the line, for each GW detection in the history listed above.

However, the pair serves a reminder that this line identifies the 2 possible sources for every LIGO detection event:

1) The number of days from the earth tide peak is shown.
2) The binary in the merger claimed by LIGO is also shown.

LIGO is required to provide evidence for all the details of their claimed detections of a gravitational wave and its source.

When LIGO offers no evidence for their source of the 97 detections, this history clearly demonstrates LIGO consistently declares an astrophysical source, by mistake, when its detectors are affected by a terrestrial source.

20.12.5 Data Set

My Excel spreadsheet with all the LIGO and earth tide events can be located via References at the end,

The zip file is LIGO-events-2021-LL.zip

The zip has the xls of that name and a pdf of that name; the pdf is a print of the worksheet, in 7 pages, for those having no spreadsheet software.

My spreadsheet also includes the list of events from GRACEDB, which presumably has fewer events removed by various filters. However, in 2021, LIGO redacted several events in GRACEDB, making its inclusion in this analysis problematic.

20.13 LIGO Conclusion

LIGO was an effort to confirm multiple important assumptions of modern cosmology:

a) Einstein's prediction of gravitational waves,

b) Existence of massive black holes,

c) Existence of massive neutron stars,

The combination of a+b is also relativity and space-time.

LIGO's achievements were heralded as confirmation of Einstein and relativity.

When searching the web for articles about gravitational waves, they consistently celebrate LIGO's accomplishments.

Perhaps, someday LIGO will provide the evidence for all their claims.

Until that time, this document presents all the relevant evidence available.

LIGO's mistakes should be heralded as the unfortunate result of an effort determined to confirm a failing cosmology. This effort required claims of detecting non-existent theoretical entities, including waves and massive bodies. Had anyone firmly required evidence from LIGO starting with the first GW, the debacle would have been avoided. With LIGO, evidence is not required when the result matches the requirement of the exercise.
Many cosmologists remain committed to the current course, regardless of opposing views providing evidence for their attempt to deflect that wrong course.
I have self-published 7 books pointing out a number of apparent mistakes in physics. I can only put them into the public record for reference.

LIGO claimed to be confirming 2 very important cosmological entities, a black hole and neutron star. Both arose because modern cosmology ignores plasma physics, and both violate principles of physics.

LIGO provided an illusion of confirmation. Until LIGO is discredited, this illusion persists and the other mistakes in physics remain, unaffected.

One can only remark: changing the path of a science, when outside its core group, is impossible.

21 Final Conclusion

When astronomers measure the velocity of a star in the Milky Way, there is no span of intervening intergalactic space holding atoms to affect the light and its spectrum by introducing absorption and emission lines. For most stars, these atoms are on or very close to the photosphere, so the atoms are moving with the star. When this is true, an astronomer can measure the motion of either the photosphere or the atoms on it. The photosphere is a physical surface radiating a spectrum of thermal radiation, enabling the measurement of the surface temperature. We classify stars by their surface temperature, within several specific ranges. When the star is moving in the line of sight to Earth, then by the Doppler effect, its entire spectrum is shifted toward blue (moving toward) or red (moving away). Atoms moving with the star will have their lines shifted by the same amount because the velocity and direction are the same. Atoms in the line of sight but not moving with the star will not have their lines shifted like those on the star because velocity and direction are not the same.

With a galaxy, the measurement of its velocity relative to Earth is completely different. The galaxy core has its electrical connection to the local galaxy cluster. These intergalactic current filaments have been detected and measured by the magnetic field generated by the current.

With a galaxy, all the absorption and emission lines are from atoms in the line of sight and the atoms are not moving at the same rate as the galaxy. Simply consider the momentum for each at the same velocity. A galaxy's mass comes from millions of stars each having an uncountable number of atoms. A galaxy requires an incredible amount of energy to put all its stars in motion in the same direction. A galaxy can move only very slowly, while an atom can move at high velocities. In practice, the galaxy can be assumed as not moving when compared to a very low mass atom.

Therefore, none of the lines can indicate any motion of the galaxy. The velocity of a galaxy cannot be measured like with a star. Only an individual star has a spectrum being shifted by the motion of the light source, the photosphere.

Therefore, the only way to measure the velocity of a galaxy is by measuring the relative velocity of every individual star and then analyze the entire set to extract the trend of the entire galaxy. This procedure requires resolution to individual stars, to record the full spectrum of each.

Cosmology has several serious problems when measuring galaxies:

1) Any galaxy redshift measured from atoms in the line of sight cannot be treated as its velocity.

The only way to measure a galaxy's velocity in 3-dimensions, like left/right, up/down, forward / away, or in / out.

It is a crucial mistake to assume galaxies move only in a straight line relative to Earth. Currently, this is because the Doppler effect can indicate only motion directly in the line of sight.

2) Hubble's Law and Constant are based on the illusion of this linear motion. In reality, galaxies and quasars are not moving only directly away from Earth.

Astronomers measured transverse motion in the only galaxies ever attempted, the 2 Magellanic Clouds. Both had sets of stars having transverse motion. This conflicts with their measured redshifts, which could never measure motion beyond the line of sight.

All current galaxy and quasar recession velocities are invalid.

Only distances based on luminosity, and when not using redshift, are valid. Cepheids are one example.

Therefore, nearly every distance and velocity value for galaxies and quasars must be withdrawn, because only a few galaxies by having a Cepheid, have a justifiable distance.

To measure a galaxy distance by a measured drop in luminosity like done with Cepheids requires a verified luminosity for that galaxy type when at a benchmark distance.

Comparing different galaxy types is invalid, because their brightness is different even when both are at the same distance.

This comparison between galaxies at different distances is complicated by factors like their differences in a) size, b) disk inclination, c) dust cloud distribution, d) star count, e) globular clusters, including the size and star count of each.

As the distance to a spiral galaxy increases, the capability of a reliable count of its individual stars decreases. Counting the number of obscured stars in the disk or bulge is difficult without dust clouds; if present then the count of invisible stars cannot be known. I expect there must be a stated margin of error for each attempt

As the distance to an elliptical galaxy or globular cluster increases, the capability of a reliable count of its stars decreases. Counting the number of obscured stars in the sphere is difficult or impossible, and would require a stated margin of error for each attempt.

These rough comparisons can result in only a rough estimated distance.

Astronomers must explain that we have never measured any galaxy’s true motion. This is a direct contradiction to the decades of claiming the universe started with a big bang and space itself is somehow expanding.

Unverified theories have been taught and proclaimed as fact for many years. That persistent deception must eventually hit the necessary consequences.

Long ago in the years before 1975, Mercury was thought to be in tidal locked rotation with the Sun. In 1975, a space probe, Mariner 10, visited Mercury and measured its actual rotation. This mistake, caused by observing only from Earth, required a space probe to identify it. A simple, basic mistake and its fix affected many reference materials about our planets.

Fixing the wrong velocity and distance for every galaxy is a similar situation, driven by a mistake with a simple measurement, affected by the line of sight from Earth.

Unfortunately, the scope of recovering from this mistake of measurement is many magnitudes larger.

The recovery also must include the removal of the big bang from cosmology, and the public’s view of our current understanding of our universe. As the author’s other books noted, the recovery should also include the removal of relativity from cosmology and physics.

Many other mistakes like big bang, black holes, dark energy, dark matter, and expansion must depart, as well. All are mistakes driven by accepting claims having no evidence.

23 References

The references in the book are available as clickable links from a page in the author's web site.

1. Start web browser
2. Go to this site: www.cosmologyview.com
3. Make sure the browser is on the correct home page:

Cosmology Views

4. Scroll to near the middle.
5. Select: **Books by the author**

This page presents information for each book.

Locate the rows and columns for this book.

6. Locate: **Century of Confusion for Cosmology**
7. Below it, locate the date of this book's edition:

November 9, 2021 References

8. Select: **References** link after the correct date.
9. This selection presents a web page.

The page will list the references in the book by page number, with a link to that reference.

Each link indicates whether it is to a pdf, a YouTube video, or a URL link to a web page. The user is aware of what the browser will do with the link. Some browsers do a download of a pdf before its display.