Detecting a Gravitational Wave

David W. Michalets

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Abstract

Detecting a gravitational wave is done indirectly.
LIGO claims gravitational wave detections from a distant astrophysical source.
During that merger of two large masses gravitational waves are radiated away.These waves cannot be measured directly.
There is a possible terrestrial source of a wave in the crust as well.
This is a study of detecting gravitational waves and whether the reported detections are valid. If LIGO did not identify the source of the detection correctly using an indirect method and an alternate source is also possible then the LIGO wave detections must be verified.

Contents

1 Introduction

Detecting a gravitational wave is done indirectly.

LIGO is the Laser IFM

Gravitational-Wave Observatory which was designed to detect these gravitational waves. LIGO claims G-W detections from an astrophysical source, a binary of large masses which spiral, collide, merge, and form one black hole at the end.

This is a study of the method used by LIGO to detect G-W and

whether those detections require further verification. There is a possible terrestrial source which the LIGO system can detect so both this method and the detections are reviewed knowing about this possible terrestrial source for the wave detections.

2 Wave Definitions

two types of waves are involved here.

2.1 Gravitational Wave

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 terms of Classical physics:

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.

(Reference 6.1)

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.

(Reference 6.2)

My comment 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 using classical physics where gravity is a measurable force between 2 known masses. The wave definition does not describe the mechanism of its propagation, such as either longitudinal or transverse nor does it define the medium for this wave's propagation. Space-time is a 4-dimensional coordinate system defined by relativity and is not a medium for an undefined wave.

LIGO built a system to detect an undefined wave having no defined medium for its propagation, though LIGO expects this wave will stretch and squeeze matter (like 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 'squeeze and stretch' and an assumed velocity.

LIGO is designed to detect a gravitational waves 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 Earth.

The conclusion of this paper is LIGO must verify whether this system detected a gravitational wave by this indirect method based on assumptions. Without that verification by an independent observation, a LIGO detection could have been a different wave coming from a terrestrial source which is present with every apparent detection. LIGO has never tested this system with a known gravitational wave to verify any of the assumptions.

2.2 Earth Tide Wave

Excerpt from the Wikipedia description

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. (Reference 6.3)

My comment about earth tides: There are 5 types of earth tide events as the terrestrial source: Full Moon, New Moon, Perigee, Perihelion, 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.

(Reference 6.4)

The other 4 earth tide event types are well known to astronomers, needing no description here.

Though the single MJ event happened only once, it is associated with 2 gravitational wave detections by LIGO, so it is in this list.

3 Verification of the Terrestrial Source

The correlation between all LIGO gravitational wave detections and a terrestrial source might not be convincing alone. However predicting a detection for an upcoming wave from this terrestrial source and having that prediction confirmed by a LIGO gravitational wave detection while the wave from this terrestrial source is present confirms the connection because this random event should not be predictable.

3.1 Hypothesis

Historically LIGO reports detections within 2 days of an earth tide for more than half of the detections. In 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 hypothesis: LIGO will report a gravitational wave detection for the ripple of an earth tide event.

I O3 more than one detection is typical.

The peak of each earth tide is known and predictable. However the Earth rotates once per day. The alignment of Earth, Moon, and Sun for a full moon or new moon takes a number of days for its effect to begin and end. O3exhibits a wider range than O1 and O2. 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 definable for the LIGO detectors. However one should expect its ripple to span beyond just the date of its peak.

3.2 Prediction Development

Because of LIGO's inherent inconsistency which is increasing in 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 picked this post for my prediction in a comment. This facebook page allows comments from the public but not posts.

I intentionally made the prediction for several explicit ranges to avoid the easy dismissal of a 'one time lucky guess.'

At the moment I made the prediction the last O3 detection was on November 9.

3.3 Prediction

The prediction 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)

3.4 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, for the second range of dates in the prediction

S191120at. also for the second range

S191124be, also for the second range

S191129u, for the third range of dates in the prediction (Reference 6.6)

Summary:

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 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.

Comparing the LIGO detections to the earth tides:

These 7 detections had these deviations from the triggering earth tide: -2,-2,+5, -3, -3, +1,+3.

Each range had its clump of detections as expected in the prediction.

3.5 Conclusion from Test Results

The prediction of wave detections within specific dates was confi

rmed by these results and the hypothesis validated by this simple test. Therefore:

LIGO declares a gravitational wave detection for the ripple of an earth tide wave, making it possible to predict the wave detections.

The LIGO system 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 the history. The distribution of LIGO detections is driven by periodic earth tides.

4 Supplemental Data File

The long data table is in an external file. This table collects the public data into rows and columns for a convenient reference.

All of the LIGO gravitational wave detections were collected into one table along with their associated earth tide events. This table is in chronological order.

All the date enties use the same 6-digit date format of YYMMDD, Where the detection will have one or two letters before the date and one or two letters after the date. The earth tide dates have two letters before the date. This abbreviation was described in 2.2. For example PG150914 means perigee on 2015 - September- 14.

To distinguish between the 3 observing runs: 2015 was O1; 2017 was O2, and 2019 is O3; 2020 will continue as part of O3.

link: Table with all detections and their earth tide date

Note: pdf is about 100K.

The table lists all the gravitational wave detections, the closest earth tide event and an indicator for the number of days between the two dates.

5 References to Data in Public Sources

This paper relies on data from public internet sources.

5.1 link to NASA gravitational wave definition

page: What is a gravitational wave?

link: NASA definition of GW

5.2 link to LIGO gravitational wave definition

page: What are gravitational waves?

link: LIGO definition of GW

5.3 link to Wikipedia description of earth tide

Page: Earth tide link: earth tide

5.4 link to unique moon Jupiter alignment

page: The Moon Shines with Jupiter and Saturn This Week! Here's How to See It

link: Moon Jupiter alignment

5.5 Link to Wikipedia List of gravitational wave observations

page: List of gravitational wave observations

link: list of GW with merger

5.6 Link to GraceDB:O3 gravitational wave detections

Page: GraceDB – Gravitational-Wave Candidate Event Database

link: GraceDB - O3 detection candidates

5.7 link to the Moon phases in 2019

page: Moon Phases 2019

link: moon phases

The year at the end of the URL can be changed to the desired year.

Scroll down in link to view the phase in UTC time to be consistent with LIGO times.

5.8 Link to Perigee dates in 2019

Page: Close and Far moons in 2019

link: perigees

The year at the end of the URL can be changed to the desired year.

5.9 link to perihelion dates in 2001 to 2100

Page: Earth at Perihelion and Aphelion 2001 to 2100

link: perihelions

5.10 link to 2018 doubt of LIGO claims

Pagetitled: Danish Group's Doubts That LIGO Discovered G-W Resurface

link: 2018 news story

6 LIGO Detection Details

This paper explains how LIGO declares an astrophysical source for what was actually a terrestrial source.

The LIGO details for a G-W detection are a separate topic.

This section addresses that topic.

A gravitational wave has no definition nor a medium for its transmission.

LIGO developed a system that could detect any disturbance of the earth by placing the IFM distributed at several locations around the globe. With that system in place LIGO developed software to analyze the disturbances being detected and then determine the source of that presumed wave. LIGO deveoped templates for possible merger scenarios with the expectation those templates could be found in this signal that was designed to capture a movement in the crust even smaller than a proton.

LIGO relies on this signal analysis but this analysis has never been tested and verified.

The infamous chirp described by LIGO is not part of the detected wave. The earth tide does not have to mimic any aspect of the theoretical gravitational wave. The earth tide must only trigger the LIGO analysis. If the template is detected then the LIGO team can create its description for the event. The chirp makes media interactions congenial.

LIGO's design magnifies any disturbance many times; LIGO is proud of this sensitivity in its IFO.

The hoghest probability for this unverified system: if LIGO can really identify a 'chirp' with any earth tide wave, that ringing is from the LIGO design not from the earth tide wave. Any ringing claimed by LIGO from an earth tide wave is the edge of this surface wave at the detectors being extremely amplified by the system's design. LIGO can report multiple gravitational waves around the peak of an earth tide waves with detections both near the start, at the peak, near the end, and on days in beteween. For example, the full moon on 12/12/2019 had 2 GWs before peak, 1 GW on peak, and 3 after peak. LIGO claims it found the chirp with a gravitational wave detection but since nothing in LIGO has been verified the LIGO descriptions are meaningless.

Nothing in the LIGO process has ever been verified. Each earth tide event triggers the LIGO analysis and an unverified description is provided.

Until LIGO actually verifies the details of any detection all those details are invalid, including the chirp.

LIGO's design magnifies any disturbance many times; LIGO is proud of this sensitivity. I suggest 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 software claims it found the chirp but since nothing in LIGO has been verified the LIGO descriptions are meaningless.

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chirp but since nothing in LIGO has been verified the LIGO descriptions are meaningless.

7 Conclusion

Perhaps the 7 confirmed predictions are not sufficiient evidence for all to be convenced of this terrestrial source. All earlier detections could have been predicted in this manner, This correlation was not clear until May, 2019. The benefit of a confirmed prediction was not realized until later. These wave detections by LIGO should be random and impossible to predict but the detections are not random and the predictions were confirmed.

The terrestrial source explains the observed distribution of wave detections.

If this confirmed test is not convincing then LIGO has this consistent coincidence which must be explained. The known earth tide wave is in the crust on the same days LIGO claims a wave detection from an astrophysical source.

LIGO must provide evidence for their claim.

There is no doubt the earth tide wave is an actual crust disturbance creating a wave by Earth's rotation.

Since it is impossible to build an instrument to detect a gravitational wave, which is undefined in terms of physics as a detectable entity, LIGO had to build a system to detect something with a device, as constructed, thwhich would react in a detectable manner.

LIGO has never verified any of their claims of a merger.

For simple accountability, even a claimed merger of a pair of black holes must be confirmed simply because it could have been a pair of neutron stars. Such a mistake affects all users of LIGO data. The pair of black holes is the most common merger being claimed.

Currently LIGO could actually be detecting anything imaginable because no claim has ever been confirmed. This paper concludes every claimed wave detection with an astrophysical source actually has a terrestrial source.

LIGO must prove their claims or they must be ignored because there is a clear contrary explanation for every claim by LIGO with no verification.

Gravitational physics is based on LIGO data resulting from a terrestrial source. This science has no foundation.