LIGO – Gravity Waves or Disturbed Aether?

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Ever since the Laser Interferometer Gravitational–Wave Observatory (LIGO), one each at Hanford, Washington, and Livingston, Louisiana, allegedly detected gravity waves from merging binary black holes on September 14, 2015, there have been numerous challenges to the claim (and to subsequent claims for further detections, including even gravity waves from merging binary neutron stars on August 17, 2017). These challenges range from denying the very existence of black holes to "liberties" taken with the interpretation of the signals received at the different sites, especially the fact that these signals were pre-simulated to align with the theory of gravitational waves themselves, such that their "detection" was no more than a self-fulfilling prophecy. One particularly astute challenge stems from the claim that, if a gravity wave were to distort space-time, then not only light waves, but also the physical dimensions of LIGO itself, would be distorted, such that any alleged "perturbation" claimed to be a gravity wave due to generation of an interference pattern from the LIGO lasers could not be due to gravity waves. This possibility is examined here, with an alternative as aether disturbances included as what LIGO actually has detected.

1. Introduction

On September 14, 2015, the Laser Interferometer Gravitational-Wave Observatory (LIGO), with sites at Hanford, Washington, and Livingston, Louisiana, allegedly detected gravity waves from the merger of binary black holes 1.3 billion light-years distant in space and time. Since then, there have been numerous challenges to the validity of this observation as definitively proving the existence of gravity waves, black holes, and Einstein's space-time of general relativity, including subsequent observations up through one for margining binary neutron stars on August 17, 2017. These challenges range from denial of the very existence of black holes [1-3] to objection based on the "liberties" taken with the interpretation of the signals received at the different sites, especially the fact that these signals were pre-simulated to align with the theory of gravitational waves themselves, such that their "detection" was no more than a self-fulfilling prophecy. [1, 4-6] Especially critical are the observations of Hilton Ratcliffe, physicist, mathematician, astronomer and member of both the Astronomical Society of Southern Africa and the Astronomical Society of the Pacific. [2.c]

> *… How could the almighty collision between two supermassive bodies produce a wave lasting just a fifth of a second? … The mirrors in the interferometer are set 4 km apart … The expected change in distance over the 4-km separation … is one-thousand trillionth of a mm … equivalent to … increasing or decreasing the distance from the Sun to the next nearest star, 42 trillion km, by the width of a human hair … [T]he most precisely polished astrophysical mirrors, like those used in LIGO, … can be 50 nm further from or closer to the points of observation … a billion times bigger than the gravitational wave signature …* (Quoting Dr. Abhas Mitra, theoretical astrophysicist from Universities of Calcutta and Mumbai) … *"*[For] *the alignment of the Hanford-Livingston* [LIGO] *axis … one would expect a delay much, much less than the theoretical 8.3 ms or the measured 7 ms … [O]ne may expect only a μs delay, 7,000 times smaller than LIGO found!" …* (Quoting Dr. Bibhas De, 40-yr experienced radio-astronomer with a PhD in Applied Physics from UC-San Diego) … *"[T]here can hardly be any question that the two detectors are seeing the same thing, the exact same "wavefront" passing through them 7 ms apart …* [Is it possible] *something other than gravitational waves has been observed*[?] … *[C]onsider … the effect of geomagnetically induced currents in long metal structures …These currents …will create stresses on the* [2-km long LIGO metal vacuum] *tubes … These stresses … may … be non-negligible for LIGO response … given …* [its] *extraordinary sensitivity … September 14, 2015, was a day specifically noted for*

geomagnetic disturbances. Since these disturbance originate in the ionosphere, they would affect both detectors. The unavoidable conclusion is that LIGO did not observe gravitational waves! It simply recorded a sudden geomagnetic disturbance by virtue of its design" ...

One particularly astute challenge stems from the claim that, if a gravity wave were to distort space-time, then not only light waves, but also the physical dimensions of LIGO itself, would be distorted, such that any alleged "perturbation" claimed to be a gravity wave due to generation of an interference pattern from the LIGO lasers could not be due to gravity waves. [7]

"Gravitational waves stretch space-time, so light traveling through that space should be stretched as well. If everything is stretching, how do you know anything is stretching?"... Dr. Rani Adhikari, Physics Professor, Caltech: "I would send a laser beam down this tube and then wait for it to come back and then I would say 'well, nothing happened' because the space got stretched and the laser wavelength got stretched ... It looks the same if you got it stretched or not stretched."

This possibility is examined here, with an alternative as aether disturbances included as what LIGO actually has detected.

2. Gravity Waves Affect "Everything"

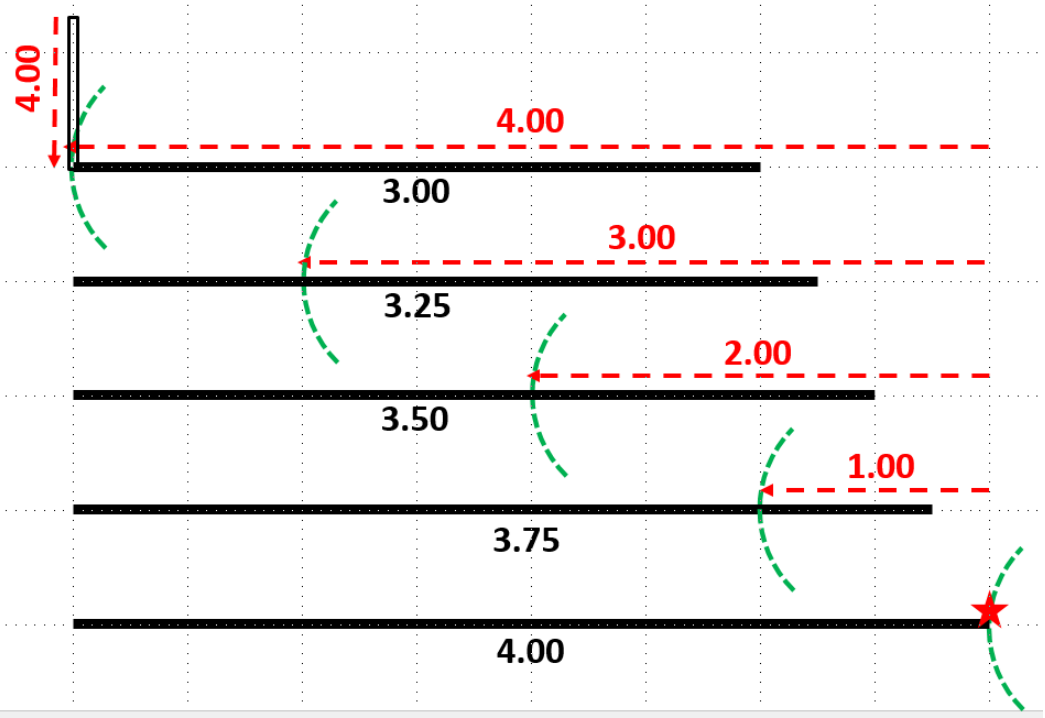

Figure 1. Schematic Showing Effect of Incoming (from Right) Gravity Wave Normal to One LIGO Arm with Simultaneously Reflected Split Laser Beam

Figure 1 depicts a gravity wave (dashed green crescent) traveling at light speed c incident normally to one of the two perpendicular, 4-km LIGO arms (solid black line). This orientation is chosen since it would produce the largest effect given the LIGO configuration. Simultaneously, the split laser beam at that end of the arm begins its reflection back (red star). Over $(4.00\ km)/(3.00x10^5\ km/s) = 1.33x10^{-5}s$, shown in four equal $3.33x10^{-6}s$ time increments it takes for the wave to travel the length of the arm, the arm is "compressed" by 0.25 km (clearly an exaggeration for the sake of illustration) per increment as space-time itself is "compressed" by the gravity wave. Once the wave has reached the intersection point between the

two arms, the reflected laser beam (dashed red arrow) has traveled 4.00 km, meeting its counterpart that has also traveled 4.00 km from when it was simultaneously reflected along the perpendicular arm (hollow, not to scale). The gravity wave has had no effect upon that arm. Therefore, despite the "space-time shift" in the one arm due to the gravity wave, the two light beams still travel the exact same distances, implying no fringe shift. This is a consequence of both the gravity wave and light traveling at equal speed c. This is NOT a representation of Lorentz length contraction, as per relativity, but of an actual "shift" in "space-time" itself, an alleged effect of gravity waves.

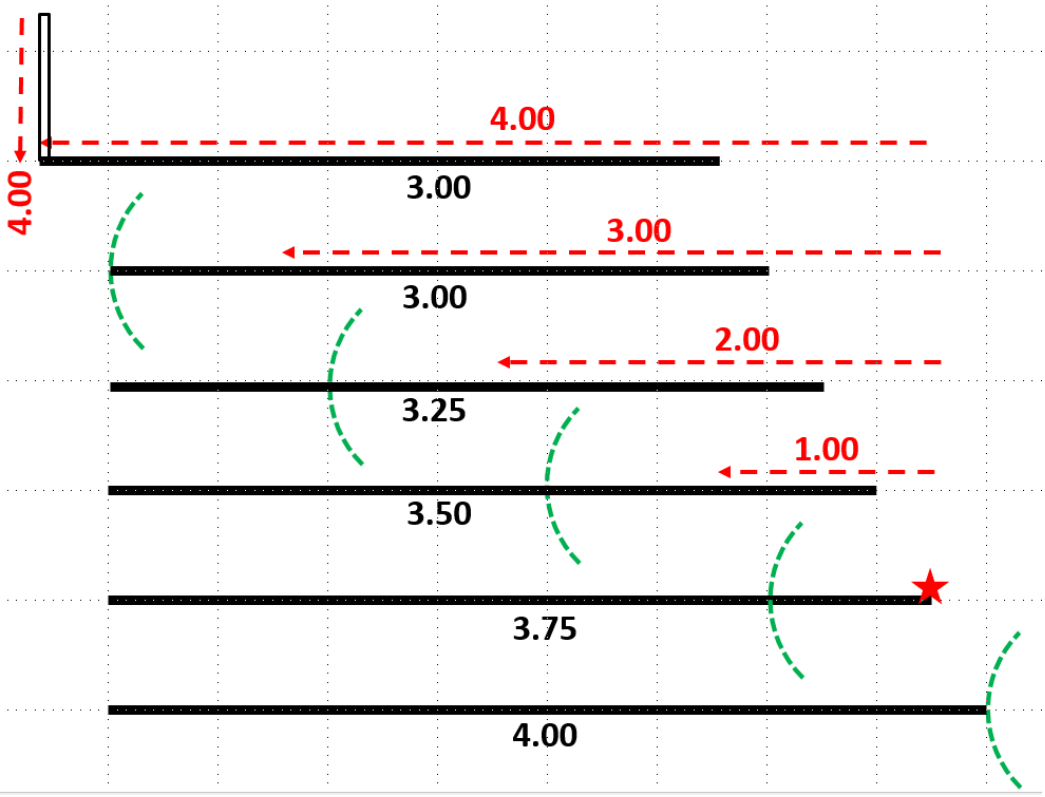

Figure 2. Schematic Showing Effect of Incoming (from Right) Gravity Wave Normal to One LIGO Arm with Subsequently Reflected Split Laser Beam

Figure 2 examines a reflected laser beam that starts back not when the gravity wave first reaches the end of the LIGO arm, but $3.33x10^{-6}s$ afterward, at which point in time the arm has already been "compressed" to 3.75 km. Again, with both the wave and light beam traveling at c, the beam reaches the intersection point between the two perpendicular arms after traveling a distance of 4.00 km, at which point the LIGO arm has been "compressed" by the "space-time shift" to 3.00 km, and its perpendicular counterpart has been shifted "left" *in toto* by 0.25 km. (Note that the gravity wave is not shown after it passes "out of the schematic." However, its space-time "shift" moves that point of intersection 0.25 km to the "left," thereby preserving the "final" compressed length of that LIGO arm at 3.00 km.) Again, a laser beam reflected back along the perpendicular arm at the exact same time as that for the "compressed" arm travels the same distance, 4.00 km, as a consequence of both the gravity wave and light traveling at equal speed c; again, there is no fringe shift.

Therefore, if a gravity wave affects "everything," i.e., all of space-time itself, as discussed by Dr. Adhikari above, LIGO could not detect one. Then, just what did LIGO detect? References 1 through 7 provide various possibilities, the one regarding a geomagnetic disturbance on geomagnetically active September 14, 2015, seeming especially plausible. One that is not discussed, at least not directly, is a disturbance of an aether medium required for light to travel as a wave with a constant speed c in a "vacuum."

3. LIGO – An Aether Detector?

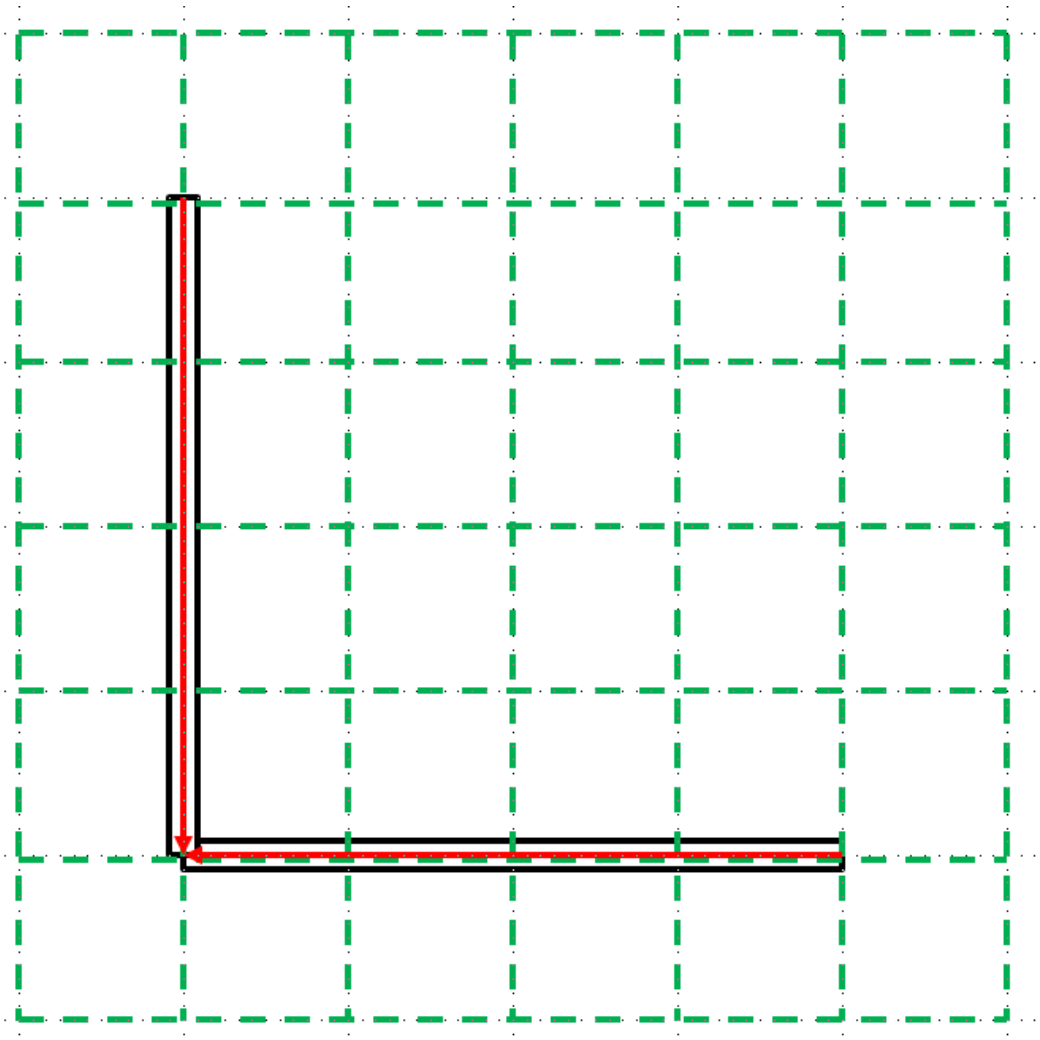

Figure 3. Schematic Showing Split Laser Beam Reflected Back along Both LIGO Arms in Undisturbed Aether

Figure 3 depicts the full LIGO arrangement (i.e., both arms) with a split, reflected laser beam (red) returning from both mirrors at the ends to the origin. The dashed green matrix represents the aether medium whose perturbation constitutes light itself, unaffected by any outside phenomenon, such as an alleged gravity wave from a collision of black holes. As expected, both split beams travel the same distance in the same time, so there is no interference pattern.

In Figure 4, "something" has happened to "compress" the aether medium in one of the directions normal to the LIGO arms (the horizontal is assumed here). Unlike a "gravity wave," which supposedly alters "everything," including space-time itself, and, therefore, the LIGO arms as well, only the aether is affected here, i.e., the arms remain unchanged. Assuming the change in the aether medium occurs much more rapidly than light speed in the aether itself, the split beam in the horizontal LIGO arm now has been "compressed" with the aether medium, such that, nearly five instead of four mesh intervals are traversed (compare numbers of meshes spanned by horizontal LIGO arm in between Figures 3 and 4). Light speed remains unaffected, so the horizontal beam still travels the same distance in the same time as before. However, since the split beam in the other (vertical) LIGO arm does not experience the effect of the aether

compression, it travels exactly as before (i.e., "uncompressed"). Now, the two beams meet again at the origin with altered waveforms (the "horizontal" one "compressed" since it has experienced the effect of the aether compression). The observed interference in LIGO from the supposed "gravity waves" thus may have been an aether effect instead due to distortion of the split horizontal beam's waveform.

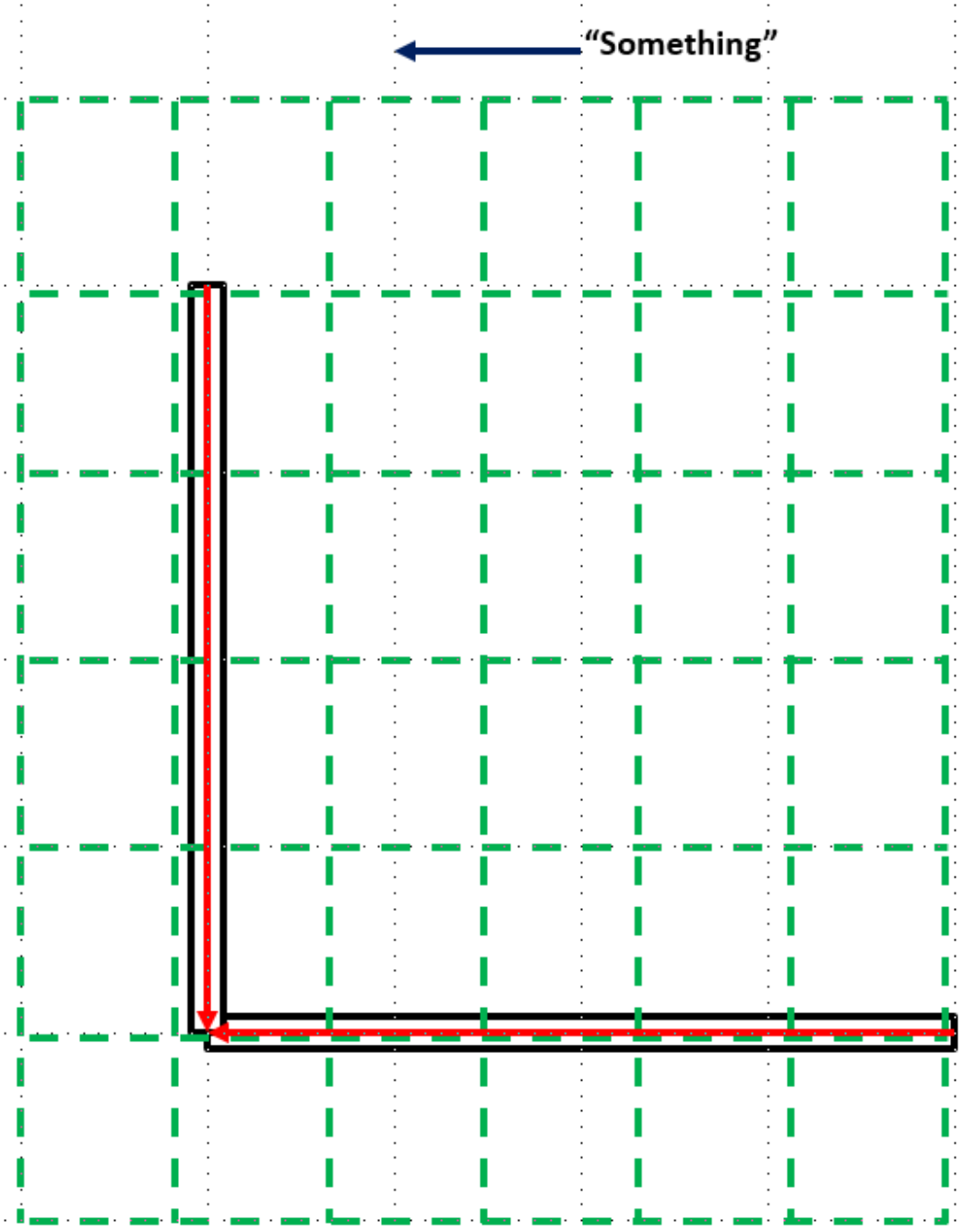

Figure 4. Schematic Showing Split Laser Beam Reflected Back along Both LIGO Arms in "Compressed" Aether[1]

[1] For the vertical arm, because aether "compression" occurs much more rapidly than the speed of light, there is no change in the split vertical beam. For the horizontal arm, because the aether "compression" occurs much more rapidly than c, the split horizontal beam gets "compressed" with the aether, distorting its waveform. This

4. Summary

What happened on September 14, 2015 (or any of the subsequent dates alleged to have validated detection of "gravity waves")? Numerous authors have offered alternative explanations to the championed "confirmation of the existence of gravity waves, black holes, and the validity of Einstein's general relativity." Among those who do not completely deny the existence of black holes is one that noted the high geomagnetic activity on that date and the likely possibility that this was what LIGO actually "detected." I have presented very simplified analyses that demonstrate: (1) if gravity waves affect "everything," i.e., all of space-time itself, LIGO should not be able to detect them; and (2) if light has an aether medium, what was alleged to be gravity waves from merging binary black holes could have been almost anything in the universe that disturbed the aether medium and, thus, had different effects on the split laser beam along the perpendicular LIGO arms due to orientation. No definitive conclusion can be drawn at this time, other than that LIGO did not detect gravity waves from merging binary black holes (or, subsequently, neutron stars) if these entities are fictitious.

References

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translates into the re-mergence of two split beams, but now with different waveforms, and manifests as the supposed "gravity wave" interference.