Ligo Gravitational waves: Ripples in Spacetime or Electromagnetic

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ABSTRACT

On Thursday Feb. 2016 the Ligo team announced the detection of gravitational waves from a collapsing black hole on Sept 14 2015. This definitively answers the question of the existence of gravitational radiation, and confirms the pulsar radiation energy Measured by Hulse, R. A. & Taylor [1], [2], but it has not yet answered definitively the question of the nature of gravitational radiation. That question is whether the radiation is a ripple in spacetime, or an electromagnetic wave, clearly the most important issue since the theory's origination in 1915. GR theorists would consider the question already answered, but there have been a number of theorists that have postulated an electromagnetic origin of gravitation, and even now the experimental evidence is not certain.

Although the loss of energy in orbiting binaries is indicative of radiational loss, it does not automatically follow that the energy is being radiated as gravitational waves. There is a long history of theories of gravitation being of electromagnetic origin, Dicke in 1957 [3], as well as others [4],[5],[6],[7],[8], have developed on the possibility that gravitation has an electromagnetic origin. This author has also developed theories depend on a electromagnetic origin for gravitational radiation, [9], [10]. Dicke's theories as well as most of the others including mine, have generally been dismissed, over the years and fallen as a result of the developments in GR.

Issues

By virtue of the physical differences in the waves The Ligo detectors can, but haven’t yet definitively answer the question as to whether the waves are actual distortions in spacetime. Electromagnetic energy with the same energy and frequency could also have been detected and produced the same signal.

The nature and theory of GR radiation, which is a ripple in spacetime, allow the waves to pass freely through mass such as the earth and thus the detectors are all sky, and are able to triangulate the source position for any coincident events. The time of arrival of the waves at three points definitively gives the position.

Electromagnetic waves however, are easily blocked by a material obstacle such as the earth, and thus an event that is visible on one side of the earth will be blocked by a detector on the other. Because of the long waves there could be some diffraction, but easily distinguished from a direct signal. As a result of this the electromagnetic event can only be viewed if the event location is above the visible horizon, with detectors on the opposite sides of the globe being silent. There is thus a filter, “the earth”, gravitational will waves pass, electromagnetic waves will be blocked!

GW150914 Observations

If the waves are electromagnetic, then the Ligo detected waves from GW150914,[11], could not have passed through the earth, and the source had to be above the horizon for both detectors. This is a bit of an issue since the burst wave analysis by the Ligo team shows an annular probability curve of the event location both above and below the horizon for an observer at the Hanford and Livingston sites, Fig.1,[12].

Probable Event Sky Location

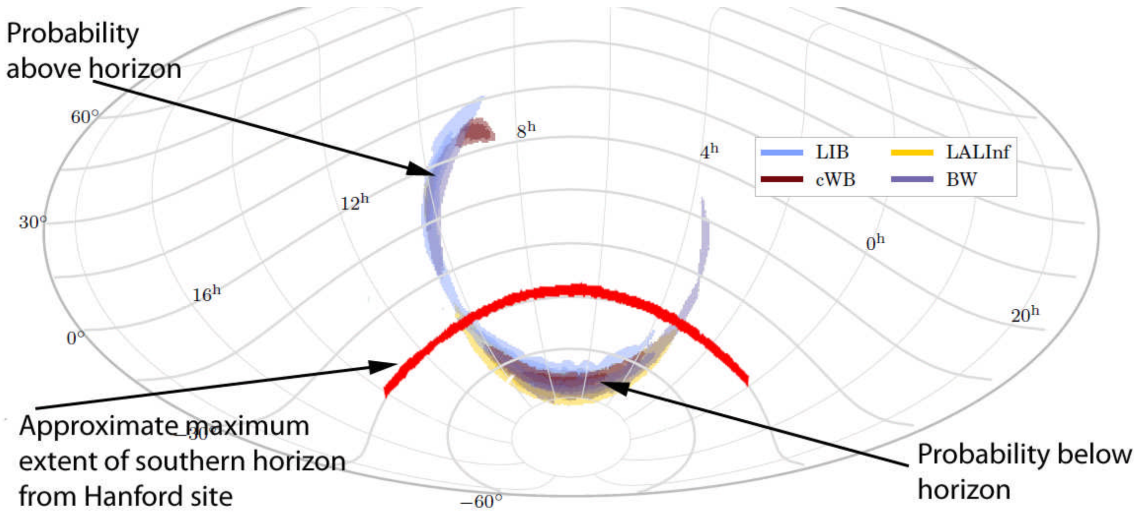

Fig 1. All-sky projections of in celestial coordinates showing probability of source location by the use of burst algorithms. [12] The diameter of the annular circle is defined by the 6.9 ms separation of the signal from the two sites. The distributed probability is defined by analysis using 4 different burst algorithm analyses of the signals. The red line is the maximum southern extent that the event could be located and still have line of sight visible from Hanford. (Appox. -44^0)

At this point the detectors in Livingston and Hanford both see approximately the same sky and cannot locate the source well enough by direct timing measurements to definitely determine whether the source location is above or below the horizon. The burst analysis data is an indicator, but it is a probabilistic indicator, and until there is an astronomically coincident event observed, or a third detector, the answer is ambiguous.

The addition of the advanced Virgo detector coming online in Italy in this year, (2016) or the LCGT in Japan will thus be able to make a definitive determination as to whether the energy propagates through the earth or is blocked. That will be the distinction as to whether the waves are ripples in spacetime or electromagnetic.

Conclusion

Detection by three detectors indicating that the waves have passed through the earth, or coincident astronomical observation will be a definitive answer that curved space is correct, however if the events are blocked by the mass of the earth, there is a problem. Since the theory of gravitation but forth by this author cannot generate gravitational waves the detection of such will be fatal to the theory.

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