Gravity experiment proposal to unite quantum mechanics and general relativity

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Abstract

Unifying the concepts of quantum mechanics (QM) and General Relativity (GR) remains an unsolved modeling problem. The prevailing model of GR is that gravitational potential is propagated as only the inverse distance from matter and without inertia. The Bohm Interpretation of QM has the proposition of an inertial pilot wave in a medium directing particles with diffraction (inertial) characteristics. Testing the similarity between the gravitational potential and the pilot wave requires showing that gravity does indeed propagate as an inertial wave rather than as only a change in potential without oscillation. The suggested experiment may measure diffraction of inertial gravity waves.

keywords: gravity, Bohm Interpretation.

1 INTRODUCTION

Unification of the big of General Relativity (GR) and the small of Quantum Mechanics (QM) depends on finding phenomena that are the same on both scales. Matter warps the "space" (also called "gravitational ether" and "plenum") of General Relativity and the divergence of "space" directs matter. Several physical interpretations of QM have been proposed. They reduce to the Schrödinger equation. The deBroglie–Bohm Interpretation (BI) seems closest to GR because it posits a "pilot wave" in a medium directs matter. The "waves" are solutions of the wave equation. Hodge (2012) posited matter creates waves in a plenum that then directs matter. A simulation program was developed and applied to diffraction of light. The simulation suggested a new experiment that was done with laser light. The experiment rejected the traditional models of wave-like light (Hodge 2015a, 2016a, and references therein). This supports the propositions of the plenum model including the nature of the waves and how waves interact with matter.

The prevailing model of gravity is that the gravitational potential $P_{NIC}(x,t) \propto 1/D$ where x are spatial coordinates, t is time, and D is the distance between

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the center of mass of an object and the point at which the gravitational potential is measured. The movement of mass only causes the gravitation change in this context. Although the change is called a “gravitation wave”, the change in $P_{NIC}(x,t)$ has no inertial component (NIC) and does not solve the wave equation. If the source mass is in a nearly circular orbit, the change in $P_{NIC}(x,t)$ at a specific spatial coordinate will sense a harmonic function. However, if the speed of a gravity change is much greater than the orbital speed of the source, the divergence of $P_{NIC}(x,t)$ will always point to the source. This implies there will not be constructive and destructive summation. That is, the $P_{NIC}(x,t)$ along the radius at a specific time will not be a harmonic function, and, therefore, there is no diffraction.

The LIGO, VIRGO, and other ground–based experiments are oriented to detect the horizontal component at different locations. If an object is in circular (inward spiral motion) the $1/D$ function should show a change with a frequency related to the objects period. The change is because the mass is in circular motion and not because the “space” is oscillating. This seems what the LIGO showed.

Another form of change in a potential includes an inertial component (IC) such as a water wave and the pendulum movement that is similar to Hodge (2012). The horizontal position of the bob plotted over time shows a wave and characterizes a solution of the wave equation. When the bob reaches its least potential energy position, it continues upward because of inertia. Inertia is required for a physical system to trace a solution of the wave equation. The water medium also forms waves that solve the wave equation because of the inertia of the medium.

That is, $P_{IC}(x,t) \propto [1 + k_1 \cos(k_2 x + k_3 t)]/D$, where k_1, k_2, k_3 are constants. The average reduces to the NIC case. The IC case does have a divergence that periodically points away from the source. The cos() is because mass acts as a sink in “space”. The BI posits a pilot wave that has an inertial component (Hodge 2016a). This form of a wave produces diffraction effects when passing an obstacle. An IC wave requires coherence to form a diffraction pattern. Coherence is formed by a single, small source or more sources with phase locked wave patterns such as in a laser. The source of a gravity wave may be considered as originating from the center of mass (a point source) of an object.

Gravity is ubiquitous. The two types of gravitational wave have an analogy in water waves around islands where the islands are like nuclei. Objects are mostly space with very small nuclei. The NIC is like a tidal wave that rises around islands. The islands make little if any effect on the wave height. The gravitational potential is the simple sum of the effects of masses on points and is not masked by another mass. The IC is like waves of the ocean. Because of the relatively large distance between islands/nuclei, the islands reflect the IC waves and the reflected waves spread from the islands. The waves in the medium undergo constructive and destructive interference and direct matter to form diffraction patterns. This is seen in a micro–scale in the Laue pattern of x-rays through crystals. This was assumed in the light diffraction simulation of Hodge (2015a).

This Paper suggests an experiment that searches for diffraction effects in gravitation potential waves rather than direct detection of the waves. Section 2 suggests the experiment. The Discussion and Conclusion are in section 3.

2 Experiment

This experiment (hereinafter "the experiment") is to measure the vertical gravitational potential on Earth using a gravimeter. Equipment to measure rapid and small vertical changes in gravitational potential monitors the gravitational potential during the passage of the diffracting object such as the Moon or Sun between Earth and suspected gravitational wave sources. The Earth's rotation moves the equipment on a given day. If gravity is an inertial wave, then diffraction fringes or a change similar to refractive index should be present. The experiment may be done with the diffracting object overhead for maximum vertical effect and between the Earth and the source. Therefore, the equipment should be mobile. This experiment requires vertical movement be isolated from horizontal movement and noise. The gravimeter should be equipped with horizontal movement detectors.

2.1 Diffraction

The diffraction of light around a round object produces diffraction rings outside of the shadow. Monitoring the change of vertical gravitational potential before and during an eclipse may show these rings. This indicates an IC wave superimposed on the tidal movement.

If the gravitational waves reflect off the atoms, a Laue pattern may be detected.

Because IC waves are likely faint, detecting these wave with the moon overhead without the solar eclipse is unlikely. However, a Fourier analysis of the three axis of movement may reveal IC oscillations.

2.2 Refractive index

A search for a refractive index may also be made during an eclipse. Objects seem to not shield gravity waves. That is, the gravity waves pass through objects like light through lenses. If the waves are refracted or slowed, an IC wave is indicated. The slowing may be detected by comparing waves in the shadow or under the moon with waves detected outside the shadow.

Alternatively, the IC wave may be focused like light through a spherical lens. The IC wave would be less near the edge of the moon's shadow and greater in the center of the shadow.

3 Discussion and Conclusion

One problem is that the conditions and the nature of the IC waves are unknown. Part of the experiment is to start the investigation by developing the characteristics of the wave.

That pendulum clocks on a wall become synchronized is well known. Perhaps such synchrony is present in astronomical observations. The divergence of the gravitational potential in the NIC model is always attractive. The divergence of the gravitational potential in the IC model may be repulsive that forms a local minimum. For example, the suggested IC oscillation in gravity may also be the cause of the "harmony of the spheres" ("music of the spheres") and other discrete cosmological spacing. The gravitational wave wavelength may be too long for the Earth–Moon distance.

A null result does not reject the hypothesis that the gravity waves have inertial characteristics. A null result may be caused by too much noise, equipment lacking the sensitivity, or the model requires refinement.

The primary reasons for doing the experiment is that it has yet to be done. If IC waves were found, Quantum Mechanics and General Relativity would be linked.

Acknowledgments

Dr. Wolfgang. Baer, Research Director, Nascent Systems Inc., 380 W. Carmel Valley Rd., Carmel Valley, CA 93924 E-mail:wolf@NascentInc.com contributed helpful comments.

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