What is the Gertsenshtein effect?

General relativity is minimally coupled to the electromagnetic field via the stress energy tensor of the electromagnetic field. Thus, it is possible for electromagnetic effects to couple to gravity and for gravity to couple to electromagnetic effects. The coupling is extraordinarily weak for ordinary fields, but it is not zero. People calculated using the theory, and Gertsenshtein was one of the first who published on one such effect that results.

Gertsenshtein considered a simple case in which an electromagnetic wave passed through a region containing a uniform and homogenous magnetic field, and he showed that a gravitational wave of the same frequency and phase as the incident electromagnetic plane wave would be expected to be generated in that way.

Zel'dovich later generalized such calculations and showed that it was also possible for gravitational waves to be incident on a region containing a uniform magnetic field and that such waves would produce electromagnetic waves. He treated the generalized case, since it was now clear that there would be normal modes which mixed the electromagnetic and the gravitational waves, in general.

He also explored medium effects, and effects of the non-linearity of quantum electrodynamics at high frequencies. The effects are very tiny, and require scales that are enormous even considering magnetic fields and length scales that might exist in astrophysics to become significant.

Here's a link to a pdf of the Zel'dovich paper. He refers to Gertsenshtein's paper.

http://jetp.ac.ru/cgi-bin/dn/e_0...

Gertsenshtein described the revolutionary concept that light passing through a strong magnetic field will produce a gravitational wave via wave resonance. ... A number of existing GW detectors are reviewed in the context of how they could be applied to measuring the gravitational waves produced by the **Gertsenshtein Effect**.Mar 16, 2005

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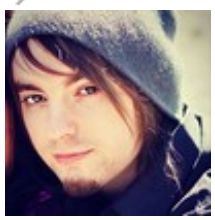

Yokai Seishinkage, Self-employed Electrical Engineer at The Yokai Experiment (2010-present)
Answered Sep 5, 2019

It is the assumption that gravitational waves accompany electromagnetic waves.

This presumed interaction between electromagnetic field quantities and gravitational field quantities arises from the non-linear terms in the Einstein equations when solving for type 2 superconductors.

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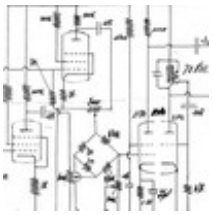

Berry J. Greene, former Long career in engineering (1900-2019)
Answered Nov 7

Gertsenshtein described the revolutionary concept that light passing through a strong magnetic field will produce a gravitational wave via wave resonance. The generation and control of gravitational waves would enable significant and dramatic advances in space communication and propulsion.

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> The possibility of gravitational waves was discussed in 1893 by Oliver Heaviside using the analogy between the inverse-square law in gravitation and electricity. 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 s...

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