Gravity as a Dielectric

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Abstract

Matter attracts matter. This mutual attraction pulls atomic structures closer together, increasing local matter density. Since all matter consists of charged constituents, this gravitational compression increases electromagnetic energy density.

Maxwell's equations show that light does not travel at a fixed speed in all media. In vacuum, where energy density is minimal, light reaches its maximum speed $\mathbf{c_0}$. Inside dielectric materials—regions of higher energy density—light slows. This is well established in classical electrodynamics.

Therefore, gravitational attraction, by increasing energy density, necessarily reduces the speed of light locally. The variation in light speed across space creates effects that are mathematically equivalent to spacetime curvature, yet arises from the geometric configuration of energy in space, which slows light rather than curves space.

1. Introduction

Gravitational phenomena are typically described by general relativity as the curvature of spacetime caused by mass-energy. This geometric interpretation has been successful in predicting effects such as light bending, redshift, and gravitational lensing.

A different view is possible—grounded entirely in classical field theory.

Matter consists of charged constituents. When matter attracts matter, it compresses this charged structure, increasing local electromagnetic energy density. This compression is a direct consequence of gravitational attraction.

Maxwell's equations show that light speed depends on the medium's permittivity $\boldsymbol{\varepsilon}$ and permeability $\boldsymbol{\mu}$. In vacuum, these take values $\boldsymbol{\varepsilon_0}$ and $\boldsymbol{\mu_0}$, yielding the maximal light speed $\mathbf{c_0}$. But in regions with higher electromagnetic energy density—such as compressed matter—light travels slower.

This implies gravitational effects on light can be explained without invoking spacetime curvature. The bending of light and gravitational redshift may instead result from variations in light speed due to energy density gradients in space. These gradients emerge from the geometric arrangement of matter and energy—which can be seen as the curvature of a metric—but are instead the result of the energy configuration itself.

This perspective reinterprets relativistic effects as consequences of electromagnetic field structure shaped by matter clustering. The parameters $\boldsymbol{\varepsilon}$ and $\boldsymbol{\mu}$ become local, dynamic functions of energy density.

2. Electromagnetic Wave Propagation in Media

Maxwell's equations in linear, isotropic, non-magnetic media are:

- $\nabla \cdot \mathbf{D} = \rho f$, where $\mathbf{D} = \varepsilon \mathbf{E}$
- $\nabla \cdot \mathbf{B} = 0$
- $\nabla \times \mathbf{E} = -\partial \mathbf{B}/\partial t$
- $\nabla \times \mathbf{H} = \mathbf{J}f + \partial \mathbf{D}/\partial t$, where $\mathbf{B} = \mu \mathbf{H}$

In free space (**ρf = 0**, **Jf = 0**), the wave equation for the electric field becomes:

- $\nabla^2 \mathbf{E} = \mu\varepsilon\, \partial^2 \mathbf{E}/\partial t^2$

Which gives the wave speed:

- $v = 1 / \sqrt{(\mu\varepsilon)}$

In vacuum:

- $c_0 = 1 / \sqrt{(\mu_0 \varepsilon_0)}$

In material media, since $\varepsilon > \varepsilon_0$ and often $\mu > \mu_0$, it follows that:

- $v < c_0$

Thus, higher electromagnetic energy density corresponds to slower light propagation.

3. Gravity and Electromagnetic Energy Density

Gravity compresses matter, increasing atomic and subatomic charge density. This increases local electromagnetic energy density due to proximity and polarization effects.

Light propagates as a wave through the electromagnetic field itself. Increased energy density modifies local permittivity and permeability, slowing light.

4. Geometry and Light Propagation

Observed gravitational phenomena such as lensing and redshift can be understood as consequences of inhomogeneous light speed caused by energy density gradients.

These gradients arise from the geometric arrangement of matter and energy—which can be seen as the curvature of a metric—but are instead the result of the energy configuration itself. Light bends because it slows near concentrations of energy, not because space itself is curved.

5. Conclusion

Gravity alters the local electromagnetic field structure by compressing matter. This changes resulting permittivity and permeability, reducing light speed locally.

The effects commonly attributed to curved spacetime can be understood through classical electrodynamics and the postulate that matter attracts matter (energy attracts energy).

The vacuum constants ε_0 and μ_0 seem to describe the limiting, lowest-energy-density case—regions.

Note

We do not claim this is an original or novel idea. This is consequence of many, multiple, different conversations held with with many people along the years; some now even dead, others prefer not to be mentioned or linked to this line of research. Thanks to all of you.