Gravity and Mass not fundamental?

By: Paul Karl Hoiland

Abstract: In this article a suggestion is raised where by gravity and mass are both emergent, not fundamental.

Starting with the Einstein equations(1) defined by

$$R_{MN} - \frac{1}{2}g_{MN}R = \frac{8\pi G}{c^4}T_{MN}.$$

In general relativity the gravitational force is represented by a Riemannian metric of curved space-time manifold M

$$\left(\frac{\partial}{\partial s}\right)^2 = g^{MN}(x)\frac{\partial}{\partial x^M} \otimes \frac{\partial}{\partial x^N}.$$

defined by the tensor product of two vector fields

$$E_A = E_A^M(x)\frac{\partial}{\partial x^M} \in \Gamma(TM)$$

Where

$$\left(\frac{\partial}{\partial s}\right)^2 = \eta^{AB} E_A \otimes E_B.$$

The vector field

$$E_A \in \Gamma(TM)$$

are the smooth sections of tangent bundle

$$TM \rightarrow M$$

which are dual to the vector space

$$E^A = E_M^A(x)dx^M \in \Gamma(T^*M), \text{ i.e., } \langle E^A, E_B\rangle = \delta_B^A.$$

If we allow that that a spin-two graviton might arise as a composite
of two spin-one vector fields(2) whereby we find the tensor product under the relationship

$$(1 \otimes 1)_S = 2 \oplus 0.$$

We then have the requirement of general covariance that gravity couples universally to all kinds of energy. Therefore the vacuum energy

$$\rho_{\text{vac}} \sim M_P^4$$

will induce a highly curved spacetime whose curvature scale R would be

$$\sim M_P^2$$

we know that QFT is well-defined as ever in the presence of the vacuum energy because the background space=time still remains flat or at least behaves as if it was flat. So while any field for fundamental particles in Standard Model cannot be written as the tensor product of other two fields only composites can it would seem the most likely case for our composite would be two parts that unite and via addition of fields cancel part of

$$\rho_{\text{vac}} \sim M_P^4$$

So that the actual background of space-time at a quantum level remains nearly flat and behaves at large scales as if it was curved.

The natural spin-one vector field is the photon. However, not all photons can be coupled to form our spin two field or there would be a stronger coupling between gravity and electromagnetism. Added to this is the SM's required Higg's field or God particle as it is sometimes referenced. While Einstein's theory requires a carrier the graviton, no such particle to date has ever been detected and no God particle has so far surfaced in high energy particle collision events.

Added to this the final observation that if one shifts a matter Lagrangian

$$\mathcal{L}_M$$

by a constant

$$\Lambda,$$

so that we have

$$\mathcal{L}_M \to \mathcal{L}'_M = \mathcal{L}_M - 2\Lambda,$$

the result is a shift of the energy-momentum tensor by

$$T_{MN} \to T_{MN} - \Lambda g_{MN}$$

which again tends to require that our background not be flat even though QM shows it to be so.

If we infer that flat space-time is the result of Planck energy condensation in vacuum which is itself a composite result of a forced false vacuum state(3) then we must accept that there are two carriers for gravity that as a composite are derived from a different set of photons than those of light. The natural solution to this that results in an additive format whereby

$$\rho_{\rm vac} \sim M_P^4$$

can cancel some 120 powers is that one set has to have negative energy and the other positive energy.

Now it is well known that under Special Relativity all particles of negative energy either real or imaginary or kinetic in origin would have a superluminal velocity. It is also well known .that Lorentz invariance must hold for SR to remain true. The simplest solution that upholds all this is that one set of what we can well define as graviphotons must exist in a separate space-time manifold where the velocity of light while not infinite is far higher than the one encountered in our manifold. In essence, we then find that while the quadrapole radiation exists, that in our manifold we can only measure one half of that field.

The zero-trace quadrupole moment tensor of a system of charges is defined as

$$\nabla^2 V - \frac{1}{c^2}\frac{\partial^2 V}{\partial t^2} = 4\pi G\rho$$

The scalar potential is given by

$$V = -N\left(i\left(\frac{1}{kr} - \frac{3}{(kr)^3}\right) - \frac{3}{(kr)^2}\right)(3Cos^2\theta - 1)e^{i(kr-\omega t)}$$

With the following relations in Maxwell format

$$B = \frac{\omega}{c^2}(r \times \nabla V) \qquad\qquad E = \frac{ic^2}{\omega}(\nabla \times B)$$

By substituting the relations the value of n can be determined

$$\varepsilon_0 = -1/(4\pi G)$$

the result yields

$$B_\phi = \frac{6N\omega}{c^2}\left[\left(\frac{1}{kr} - \frac{3}{(kr)^3}\right)i - \frac{3}{(kr)^2}\right]\left[Cos(\theta)Sin(\theta)\right]e^{i(kr-\omega t)}$$

$$E_r = 6Nk\left[\left(\frac{-3}{(kr)^3}\right)i - \frac{1}{(kr)^2} + \frac{3}{(kr)^4}\right]\left[3Cos^2(\theta)-1\right]e^{i(kr-\omega t)}$$

$$E_\theta = 6Nk\left[\left(\left(\frac{1}{kr}\right) - \frac{6}{(kr)^3}\right)i + \frac{6}{(kr)^4} - \frac{3}{(kr)^2}\right]\left[Cos(\theta)Sin(\theta)\right]e^{i(kr-\omega t)}$$

where: $N = -G\ m\ s^2\ k^3$, G = Grav const., m = mass, s = Dipole length, k = Wave number

in the limit

$(\mathrm{kr} \to 0)$.

Now if we postulate that this field is itself split into two components then the resultant is a simple dipole field with conventional EM Maxwell equations. One set of equation would involve negative energy and the other positive energy. This offers a way to test this idea out involving a search for an em signal from a predictable origin point where quadrapole radiation should be generated at about half the amplitude to be expected of the normal quadrapole gravity wave detection method, but at the same frequency of the expected quadrapole gravity field.

REFERENCES

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