DOES THE ENERGY DENSITY OF THE VACUUM INFLUENCE PLANETARY MOTIONS?

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ABSTRACT. New cosmological and quantum mechanical evidence for the existence of an ether has made it appropriate to investigate again the effect of such a medium upon the motions of planets and satellites within the solar system. The properties of a medium of this kind are as yet unknown except that it may be the ultimate origin of inertia and therefore that it may have a fundamental link to the gravitational force.

This paper discusses the pertinent consequences of associating the effects of the space-time continuum with the properties of a perfect fluid which can exert measurable forces on planetary bodies. It assumes that if the vacuum has an energy density P, then it is possible to associate with that energy density a mass density ρ so that $P = \rho c^2/2$. The resulting medium is a perfect fluid which must also satisfy the observational constraints of established dynamics in the solar system.

The treatment uses solutions of hydrodynamic flows around spheres which are at least partially impervious to the flows. One then derives the forces which can act on any body moving in such flows from the distributions of pressure in the fluid by use of Bernoulli's principle. The outcome of this calculation is that:

1. There can occur forces on orbiting planets or satellites in the solar system which are both radial and tangential to their orbits.
2. Two planets or satellites can exert mutual forces on each other which vary in strength inversely as the fourth power of distance separating them and directly as the product of their velocities through the fluid.
3. All forces are directly proportional to the mass density ρ and to the product of the effective volumes of the fluid which the interacting bodies displace.

Application of these findings to the orbit of the Moon shows that the Moon's motion through such a fluid experiences a perturbation by a tangential force which averages to zero around a complete orbit and a radial force which does not average to zero. The former force

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leads to a perturbation of the orbit at the synodic period and half the synodic period, effects which are qualitatively similar to the so called variation, the evection, and the parallactic inequality of the lunar orbit. The latter force results in a secular acceleration of the lunar motion and gives thereby a new basis for explaining this effect which should be verifiable in future experiments.

One of the first measurements which can guide the development of this theory, to test its validity and to allow deducing the unknown parameters, is the accurate determination of the rate of change of the lunar secular acceleration which then specifies the radial component of the perturbing forces. Present data are consistent with an upper bound on the rate of change of the secular acceleration of about 3 arc second/century[3], although those data do not yet span a sufficiently long interval of time. It is conceivable that precise lunar ranging would be capable of yielding these data in the future. It would then be possible to extrapolate these measurements on the Earth-Moon system to other astronomical bodies in the solar system to verify the consistency of the theory and the numerical values of the parameters.

DISCUSSION

Cannon : what is the magnitude of your effect ?

Shubert : it depends on the value of the parameter P, I have no estimation for it.