THE NOT SO CONSTANT GRAVITATIONAL "CONSTANT" G AS A FUNCTION OF QUANTUM VACUUM ENERGY DENSITY

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A critical but often underestimated question in Einstein's General Theory of Relativity concerns the impossibility to define a potential-energy function able to explain, even in the simplest case of a free falling body in a gravitational field generated by a mass, the physical origin of the energy transferred between the field itself and the falling body. This determines a known contradiction between the equivalence principle and the expression of total energy in the r,t-reference of the Schwarzschild's metric that can be formally overcame by introducing a gauge factor, depending on mass generating the field and on distance from it, affecting clocks rate, measured lengths, light velocity and the rest mass of a particle within the gravitational field. On the other hand, it has been shown that the presence of mass determines a modification of Zero – Point – Field (ZPF) energy density within its volume and in the space surrounding it. All these considerations strongly suggest that also the constant G could be expressed as a function of quantum vacuum energy density somehow depending on the distance from the mass whose presence modifies the Zero Point Field energy structure. In this paper, starting from the idea of inertial and gravitational mass of a body as the seat of standing wave of Zero Point Field and from the picture of a fluid-like model of space, it has been formulated a model of gravitational constant G as a function of Planck's time and Quantum Vacuum energy density in turn depending on the radial distance from center of the mass originating the gravitational field, supposed as spherically symmetric. According to this model, in which gravity arises from the unbalanced ZPF radiation pressure, gravitational "constant" G is not truly unchanging but slightly varying as a function of the distance from the mass source of gravitational potential itself. An approximate analytical form of such dependence has been discussed and a possible experimental test of the model, making use of precise measurements on artificial satellite around Earth outlined. The proposed model, apart from potentially having deep theoretical consequences on the commonly accepted picture of physical reality (from cosmology to matter stability), could also give the theoretical basis for unthinkable applications related, for example, to the field of gravity control and space propulsion.