

Atomic Clocks and Gravitational Field Strength

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Abstract: *Owing to the fact that gravitational field strength has the same physical effect on the internal mechanism of an atomic clock as kinetic energy does, a redefinition of potential energy will be made which better emphasizes this reality. The existing definition of potential energy with its negative sign masks the cyclical oscillation of the internal energy inside a GPS clock in an elliptical orbit.*

Gravitational Potential Energy

I. It is proposed that the gravitational potential energy of a body of mass m in the gravitational field of a body of mass M is,

$$\Psi = +2GMm/R = mu^2 \quad (1)$$

where G is the gravitational constant, R is the distance between the centres of M and m , and u is the escape velocity. The factor of 2 has been introduced to cater for the effect that gravity has on the internal structure of ponderable matter, over and above the acceleration that it causes on the large scale as measured against the motion of the centre of mass. The negative sign in the standard definition introduces instantaneous conservation of energy which has the disadvantage of masking the additive effects that gravitational field strength and kinetic energy have on the internal mechanism of atomic GPS clocks that are undergoing eccentric orbits around the Earth. Choosing a plus sign on the other hand introduces more transparency by highlighting the cyclical nature of energy conservation in GPS clock orbits. The factor of 2 deliberately doubles the normal force of gravity in order to propose the existence of a latent component which is absorbed internally by the constituent molecules of the orbiting clocks. The idea is that this latent component, not observed on the large scale, causes a torque to act on the individual constituent molecules due to their dipolar nature, hence increasing their kinetic energy. This will increase the internal energy over and above the kinetic energy on the large scale that is measured against the centre of mass.

It should also be stated that this definition of potential energy, while favourable for GPS clock orbits, is not necessarily the best for all purposes in physics on all scales.

The Aether and the Electric Sea

II. It is proposed that a dense electric sea of rotating electron-positron dipoles sits at rest within a gravitational field, and that a fluid-like aether flows through this sea into the gravitating body. See further details in section **III** below. It is further proposed that the inflow velocity is equal to the escape velocity. When gravity acts on a body, half of the force causes a linear acceleration of the body on the large scale, while due to the dipolarity of its constituent molecules, the other half of the force causes a fine-grained torque to act on these molecules. The familiar linear force causes motion with respect to the background electric sea, resulting in a physical shear interaction between the constituent molecules of the linearly accelerated body and the background rotating electron-positron dipoles. This in turn causes a fine-grained angular acceleration in both, and hence an increase in the centrifugal pressure. This means that the angular velocity of the constituent molecules will be increasing on two counts. One count is the latent inductive effect which is directly due to gravity but not observable on the large scale, while the other count, the convective effect, is only indirectly due to gravity but directly due to velocity. The latter leads to a kinetic energy $\frac{1}{2}mv^2$ which is observed on the large scale. As the angular velocity of the constituent molecules increases on either count, so will the intrinsic energy of the body. The increase in intrinsic energy is the factor which slows down an atomic clock. In a closed elliptical orbit, the intrinsic energy of a body will be maximum at its lowest height on account of both potential energy and kinetic energy, both of which will have increased from their value at the highest height.

Physical Interpretation

III. It is proposed that space is densely packed with tiny aethereal vortices that are pressing against each other with centrifugal force while striving to dilate [1], [2]. Each of these tiny vortices contains both a sink (an electron) and a source (a positron) [3], [4]. It is further proposed that the atoms and molecules of ponderable matter constitute more complex vortices. When a body linearly accelerates, the shear interaction between the constituent molecules and the background electron-positron sea (The Electric Sea) leads to angular acceleration of the constituent molecules and the electron-positron dipoles, and this has the effect of increasing the fine-grained centrifugal pressure which we know as *kinetic energy*. Kinetic energy is a pressure which is induced either by acceleration or when a fine-grained angular acceleration wave emitted from one body delivers kinetic energy into another body during a collision [5]. When this happens, the other body then linearly accelerates.

It is proposed that gravity is tensile aether on the large scale, flowing into the sinks in all matter, and that in doing so it superimposes on the local flow around and within the tiny aether vortices that fill all of space. Due to their dipolarity, these tiny vortices are caused to precess hence inducing centrifugal pressure to act at right angles to the gravitational field lines. The sea of tiny aether vortices also absorbs any vorticity in the gravitational field, hence ensuring that gravitational fields are predominantly irrotational. In an uncompressed orbit [6], the sea of tiny vortices is entrained within each gravitational field. The tension that exists at the interface between two gravitational fields, so as to cause attraction, is undermined by centrifugal pressure coming from the tiny vortices. The greater the shear velocity between the two gravitational fields, the greater will be the centrifugal pressure that tends to push the two bodies apart.

Centrifugal pressure is the basis of all intrinsic energy in atomic and molecular matter, and also in the electron-positron sea. It is the *rest mass* energy mc^2 where c is the circumferential speed of a compressed molecular orbit [6]. In the case of the electron-positron sea, it is proposed that c will be the speed of light, and hence each dipole will have a stored centrifugal potential energy of 1.02MeV. When a gamma photon, itself constituting propagated centrifugal pressure, supplies an additional 1.02MeV on top of this, the electron and positron in the dipole can then overcome the external centrifugal pressure and escape from their lattice bonds, leading to electron-positron pair production [7].

Kinetic energy in atomic and molecular matter is an additional $\frac{1}{2}mv^2$ on top of the rest mass energy, where v is the translational speed of the body. The total energy E is therefore,

$$E = mc^2(1 + v^2/2c^2) \quad (2)$$

assuming mass to be constant. It's like a kind of longitudinal Doppler shift of the rest mass energy.

The Myth of Time Dilation

IV. So far, we have only been dealing with classical energy quantities within the mechanism of atomic clocks. The gravitational field strength and the kinetic energy increase and decrease simultaneously throughout an eccentric orbit, and in doing so this will naturally alter the rate at which the clocks tick. Since this is indeed observed, it is held up as proof of Einstein's special theory of relativity.

But in order to actually justify the special relativity equation for time dilation, we have to fudge the issue by converting equation (2) into the transverse Doppler shift format. Using the binomial expansion, and only

providing that v^2/c^2 is small, equation (2) is approximately equivalent to saying that the total energy equals,

$$E = E_0 \sqrt{1 - v^2/c^2} \quad (3)$$

where E_0 is the rest mass energy. And presumably the higher the intrinsic energy, the slower the clocks will tick, since the caesium atoms' electron orbitals will be at a higher energy level, and so the lesser the frequency of EM radiation needed to cause an upward transition. There is no basis in general though to assume that c is equal to the speed of light, as this likely only occurs in the special case of the electron-positron sea itself where c equates to the circumferential speed of the individual rotating electron-positron dipoles [8]. The electron-positron sea, having a density much higher than the orbital electrons in ponderable atoms and molecules, will therefore have much higher circumferential speeds.

When bodies are small, the gravitational fields of their individual molecules don't collectively entrain the surrounding electric sea, therefore when in motion, the electric sea flows between the molecules as like water flowing through a basket. When gravity acts on a dipole, it causes both an angular acceleration and a linear acceleration. Therefore, when gravity acts on a terrestrial body or on an artificial satellite, the intrinsic energy will first be increased by an induced precession in its constituent dipolar molecules. This fine-grained precession will not show up externally, but it could show up within the operation of an atomic clock. It's like a latent kinetic energy based on the inflow speed of the aether.

On the proposition that the inflow speed is equal to the escape velocity, then substituting equation (1) into equation (3), we obtain,

$$E_0 \sqrt{1 - u^2/c^2} = E_0 \sqrt{1 - 2GM/Rc^2} \quad (4)$$

When the body starts to linearly accelerate, the interaction with the surrounding electric sea induces yet more intrinsic energy. The latter is the observed kinetic energy.

But none of this is special relativity. It's nothing other than the cyclical oscillation of mechanical energy throughout the course of an elliptical orbit.

References

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"All space, according to the younger Bernoulli, is permeated by a fluid aether, containing an immense number of excessively small whirlpools. The elasticity which the aether appears to possess, and in virtue of which it is able to transmit vibrations, is really due to the presence of these

whirlpools; for, owing to centrifugal force, each whirlpool is continually striving to dilate, and so presses against the neighbouring whirlpools.”

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