Atomic Clocks and Gravitational Field Strength

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Abstract: *A redefinition of potential energy better emphasizes the physical reality of gravitational field strength. The current definition only deals with motion on the large scale and not with the fine-grained motions at molecular level which are relevant to the mechanism of atomic clocks.*

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,

$$\mathit{\Psi} = +2GMm/R = mu^2 \qquad\qquad (1)$$

where *G* is the gravitational constant, *R* is the distance between the centres of *M* and *m*, and *u* is the escape velocity. This conflicts with the standard definition on account of both the plus sign and the factor of 2. The negative sign in the standard definition introduces instantaneous conservation of energy which has the disadvantage of masking the cumulative effects in eccentric orbits. Choosing a plus sign on the other hand introduces more transparency by highlighting the cyclical nature of energy conservation. 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 matter. The idea is that this latent component, not observed on the large scale, causes a torque to act on individual molecules due to their dipolar nature.

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 induces a convective effect with respect to the background electric sea. There will be a 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 *½mv²* 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 screwing pure pressurized aether out of the positive particles. Kinetic energy is therefore 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 the molecular orbit. 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 ***½mv²*** on top of the rest mass energy, where ***v*** is the translational speed of the body. The total energy is therefore equal to ***$mc^2(1 + v^2/2c^2)$***, assuming mass to be constant. Using the binomial expansion, and only providing that ***v^2/c^2*** is small, this is approximately equivalent to saying that the total energy equals ***$E/\sqrt{(1 - v^2/c^2)}$***, where ***E*** is the rest mass energy. 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 [8]. The fact that these relationships superficially resemble equations associated with Einstein's special theory of relativity is only because in both cases the equations are similar to the equations of the Doppler shift.

When bodies are small, the gravitational fields of their individual molecules don't collectively entrain the 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 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. Treating it as such and when combined with the rest mass energy, the total energy then becomes ***$E/\sqrt{(1 - u^2/c^2)} = E/\sqrt{(1 - 2GM/Rc^2)}$***.

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

References

[1] Whittaker, E.T., ***"A History of the Theories of Aether and Electricity"***, Chapter 4, pages 100-102, (1910)
"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."

[2] Clerk-Maxwell, J., ***"On Physical Lines of Force"***, Philosophical Magazine, Volume XXI, Fourth Series, London, (1861)
http://vacuum-physics.com/Maxwell/maxwell_oplf.pdf

[3] Tombe, F.D., ***"The Double Helix Theory of the Magnetic Field"*** (2006)
Galilean Electrodynamics, Volume 24, Number 2, p.34, (March/April 2013)
http://gsjournal.net/Science-Journals/Research%20Papers-Mathematical%20Physics/Download/6371

[4] Tombe, F.D., ***"The Electron-Positron Sea"*** (2014)
http://gsjournal.net/Science-Journals/Research%20Papers-Quantum%20Theory%20/%20Particle%20Physics/Download/5507

[5] Tombe, F.D., ***"Newton's Cradle Disproves Einstein's Theories of Relativity"*** (2014)
http://gsjournal.net/Science-Journals/Essays-Mechanics%20/%20Electrodynamics/Download/5737

[6] Tombe, F.D., ***"Compressed Orbits and the Secret Behind $E = mc^2$ "*** (2017)
http://gsjournal.net/Science-Journals/Research%20Papers-Astrophysics/Download/6767

[7] Simhony, M., ***"The Electron-Positron Lattice Space, Cause of Relativity and Quantum Effects"***, Physics Section 5, The Hebrew University, Jerusalem (1990)
http://web.archive.org/web/20040606235138/www.word1.co.il/physics/mass.htm

[8] Tombe, F.D., ***"The 1856 Weber-Kohlrausch Experiment"*** (2015)
http://gsjournal.net/Science-Journals/Research%20Papers-Mathematical%20Physics/Download/6314