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Restoring the Physical Meaning of Energy

—Distinguishing Between the Apparent Energy and the Real Energy of Moving Mass

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Abstract

By referencing the rest-frame of the aether it becomes possible to distinguishing between the ***apparent*** energy and the ***real*** energy of moving mass. It is shown that there is no theoretical obstacle in distinguishing between observer-dependent energy and observer-independent energy. Similarly, the referencing of motion to the space medium restores the physical meaning of clock time, length contraction, and momentum. Furthermore, by incorporating Williamson's bound-radiation theory of atomic particles, the total conversion of mass to energy is given a clear physical interpretation.

Keywords: energy, apparent energy, real energy, total energy, kinetic energy, mass invariance, aether, aether frame, intrinsic motion, DSSU

1. Introduction

1.1 The Problem

Energy has a simple definition: It represents, in physics, the capacity for doing *work*. Energy manifests as mass-energy and radiation-energy and motion-energy.

Energy enters into all dynamical processes. Matter itself is a highly localized form of energy—called *mass*.

The role of energy is fundamental. The operation of the universe is ruled by the law of conservation of energy.

The problem is that conventional Physics is ruled by a theory which undermines *that* fundamental role. For over 100 years Einstein's theory of relativity has dominated the theoretical formulation of energy. Contained in the theory's expression for mass-energy is the speed of the object. But this speed is not any ordinary speed; it is the ***relative speed*** between the observer and the object. It is the "relativism" of this speed that allows every inertial observer to assign a different velocity magnitude, and thus a different energy, to any given object or particle! If different observers cannot agree on the mass energy of one-and-the-same object, then the fundamental role of energy is lost.

The problem, expressed another way, is that Einstein's relativistic energy equation, $E_{\text{total}} = \gamma\, mc^2$, represents only the ***apparent*** total energy. It does not and cannot provide the underlying intrinsic total energy—what some would call the object's *real* energy.

Here is how the Italian physicist Franco Selleri describes the energy problem. He considers it a paradoxical "conflict between the reciprocal transformability of mass and energy and the ideology of relativism, which declares all inertial observers perfectly equivalent ***so depriving energy of its full reality***" (Selleri, 2004, emphasis added).

Selleri continues, "Every inertial observer assigns a different velocity, and thus a different energy, to any given particle." And because of the impossibility of choosing one of these as being "more true" than another, "one is forced to conclude that a real value of energy does not exist. In this way energy is at once stripped of the property of having a well-defined numerical value" (Selleri, 2004).

2. The Resolution

While Einstein's theory provides us with an observer-dependent energy concept; what is needed is an energy

formulation that is *independent* of the observer.

We start with the textbook expression for the apparent total-energy of mass *m*:

$E_{\text{total}} = \gamma\, mc^2$, which expands to

$$E_{\text{total}} = \frac{1}{\sqrt{1-(\upsilon/c)^2}} \times mc^2 . \tag{1}$$

The symbol υ represents the relative speed between the observer and the mass object. Calling it a "relative" speed means that the apportionment of *that* speed to the observer and the object is not important. Whether the observers, say, in a spacecraft approaching an asteroid, assert that υ is the spacecraft's forward speed or the asteroid's approach speed does not matter. It matters not, because υ is simply an ***apparent*** speed that helps quantify the ***apparent*** total energy.

Our universe, the Dynamic Steady State Universe (DSSU) (Note 1), is dominated by the presence and the dynamics of a detectable aether medium. By referencing this medium it becomes possible to express the single *relative* speed in terms of two aether-referenced (intrinsic) speeds.

The equation that makes this conversion is (Ranzan, 2010a)

$$\upsilon = \frac{\upsilon_{\text{A}} + \upsilon_{\text{B}}}{1+\left(\upsilon_{\text{A}}\upsilon_{\text{B}}/c^2\right)} . \tag{2}$$

The symbols υ, υ_{A}, and υ_{B} represent collinear velocities or velocity components; c is the speed of light. The intrinsic motion of the observer (assigned to reference frame "**A**") is given by υ_{A}, and the intrinsic motion of the mass body (assigned to reference frame "B") is given by υ_{B}. And, of course, the relative motion between them is υ.

By substituting Equation (2) into (1) we obtain,

$$E_{\text{tot}} = \frac{1}{\sqrt{1-(\upsilon_{\text{A}}/c)^2}\sqrt{1-(\upsilon_{\text{B}}/c)^2}}\left(1+\frac{\upsilon_{\text{A}}\upsilon_{\text{B}}}{c^2}\right)mc^2 , \tag{3}$$

which is still the expression for the ***apparent*** total energy, but now expressed in terms of aether-referenced motion.

From this expression we are able to extract the object's ***real*** total energy—the energy as a property independent of the observer—by simply removing the motion of the observer. The speed of the observer, υ_{A}, is, mathematically, set to zero. The result is the ***total real energy*** of mass body *B*:

$$E_{\text{tot.real}} = \frac{1}{\sqrt{1-(\upsilon_{\text{B}}/c)^2}} mc^2 . \tag{4}$$

(Observer-independent total energy of an object)

Significantly, there is no reference to the observer's speed in the expression. Setting the speed of the observer to zero is equivalent to embedding the observer into the rest frame of the aether medium.

The only non-constant on the right-hand side is the intrinsic speed of the mass body *B*. The challenge is to determine that speed.

3. Radar Method to Determine an Object's Aether-Referenced Speed

Let us consider a hypothetical situation of a spacecraft and an asteroid. The deep-space encounter, as viewed from the aether rest-frame, is shown in Figure 1.

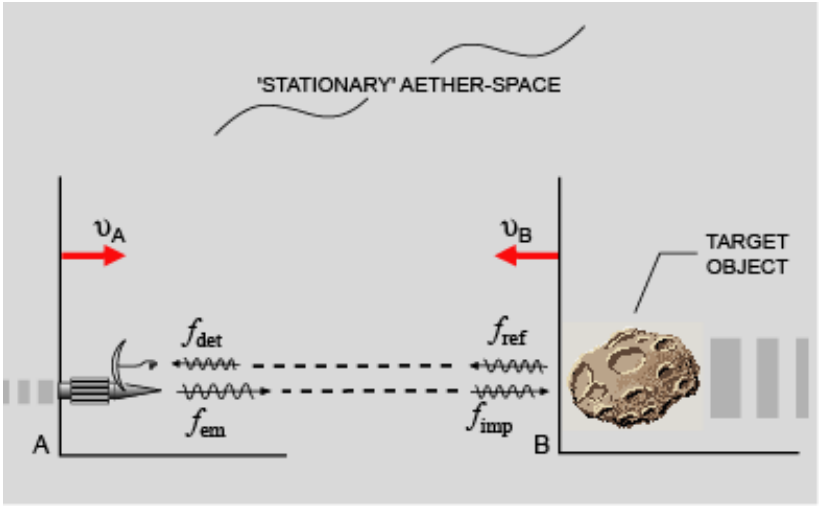

Figure 1. Doppler radar scenario within aether-space. Spacecraft "A" emits radar signal with frequency f_{em} and detects the return signal as frequency f_{det}. The signal impacts the target with a frequency f_{imp} and is reflected with frequency f_{ref}. In the reference frame of "B", frequency f_{imp} equals f_{ref}

The spacecraft is equipped with Doppler radar, which emits a frequency f_{em} and impacts with a frequency f_{imp}. In accordance with the DSSU Doppler equation, the two are related as (Ranzan, 2010a),

$$f_{\text{IMPACTS@B}} = f_{\text{EMITTED@A}} \sqrt{\frac{1-(\upsilon_A/c)}{1+(\upsilon_A/c)}} \sqrt{\frac{1-(\upsilon_B/c)}{1+(\upsilon_B/c)}} . \tag{5}$$

The asteroid (frame *B*) reflects the radar signal which is subsequently detected by the spacecraft (frame *A*). The two frequencies are related, again in accordance with the DSSU Doppler equation, as (Ranzan, 2010b),

$$f_{\text{DETECTED@A}} = f_{\text{REFLECTED@B}} \sqrt{\frac{1-(\upsilon_B/c)}{1+(\upsilon_B/c)}} \sqrt{\frac{1-(\upsilon_A/c)}{1+(\upsilon_A/c)}} . \tag{6}$$

Since the frequency of an electromagnetic signal is not changed by a simple reflecting process, the impacting frequency must equal the reflecting frequency. That is, f_{imp} equals f_{ref}. Therefore, Equations (5) and (6) may be combined to give,

$$\frac{f_{em}}{f_{det}} = \frac{(1+\upsilon_A/c)}{(1-\upsilon_A/c)} \frac{(1+\upsilon_B/c)}{(1-\upsilon_B/c)}, \tag{7}$$

where υ_A and υ_B are collinear velocities with respect to aether. Solving for υ_B gives an expression for the aether-referenced velocity of the radar's target (labeled "B" in Figure 1):

$$\upsilon_B = \frac{(f_{em}/f_{det})(1-\upsilon_A/c)-(1+\upsilon_A/c)}{(f_{em}/f_{det})(1-\upsilon_A/c)+(1+\upsilon_A/c)} \times c . \tag{8}$$

The spacecraft observer calculates υ_B by using the instrument readings for the emitted and detected frequencies; and the known constant c; and an instrument measurement of the ship's own intrinsic speed υ_A. The latter can be measured with a gas-mode Michelson-Morley interferometer as described in (Ranzan, 2012); or with one of the new techniques being developed (Cahill, 2006a, 2006b, 2011).

As long as the asteroid is not subject to any force, then υ_B does not change. And significantly, all uniformly moving observers will agree on its value.

Consequently, all such observers will agree on the real *total energy* as determined by Equation (4) and into which υ_B is substituted.

4. Discussion

4.1 Energy of Terrestrial Objects

What about the real *total energy* of some object resting on Earth? The aether flow through the Solar system is about 400 *km/s*, which means that the Earth's orbital motion of 30 *km/s* and Earth's daily rotational motion are comparatively negligible. Thus the speed that enters the energy Equation (4) would be about 400 *km/s* (Ranzan, 2012).

4.2 Does Mass Increase with Speed?

The French theorist, Henri Poincaré, in 1904 showed that the mass of an object increases as the object's speed increases. Furthermore, there is a maximum speed, the speed of light, which limits the motion of any object. Both of these ideas are included in Einstein's special theory of relativity (Spielberg & Anderson, 1985).

It is important to realize that the property of mass of an object or particle—contrary to Poincaré, Einstein, and popular belief—does *not* increase with motion.

The energy of an object in motion consists of two parts: the rest-mass energy and the kinetic energy. In fact, the object's total energy is defined as,

$$Total\ Energy = (Mass\ Energy) + (Kinetic\ Energy), \tag{9}$$

(This definition, Equation (9), applies to all speeds)

$$Total\ Energy = mc^2 + \tfrac{1}{2}mv^2 . \tag{10}$$

(This expression is for low speeds).

It is only the *kinetic-energy* portion that increases with speed NOT the *mass-energy* part.

The mass-energy part, mc^2, is also known as the ***rest-energy*** part. Some may find this terminology, of associating moving mass with rest mass, misleading. The point to keep in mind is that the "rest-energy part" *does not change with motion*. Regardless of the state of motion of mass *m*, its rest-mass value remains constant.

Mass does not increase with speed. When an object's total energy changes, it means that its kinetic energy changes.

4.3 Kinetic Energy for High Speeds

The standard textbook expression for kinetic energy *K* is,

$$K = mc^2\left(\frac{1}{\sqrt{1-(\upsilon/c)^2}}\right) - mc^2 , \tag{11}$$

where υ is the relative speed.

The equivalent DSSU expression for kinetic energy is (Ranzan, 2010),

$$K = mc^2\left(\frac{1}{\sqrt{1-(\upsilon_A/c)^2}\sqrt{1-(\upsilon_B/c)^2}}\left(1+\frac{\upsilon_A\upsilon_B}{c^2}\right)\right) - mc^2 \quad , \tag{12}$$

where υ_A, and υ_B represent aether-referenced speeds. Since both of the above expressions depend on the motion of the observer, they therefore represent ***apparent*** kinetic energy.

The intrinsic kinetic energy K_{int} is,

$$K_{int} = mc^2\left(\frac{1}{\sqrt{1-(\upsilon_{mass}/c)^2}}\right) - mc^2 , \tag{13}$$

where υ_{mass} represents the object's aether-referenced speed.

These expressions, (11), (12), and (13), only say that the kinetic energy increases as a complicated function of the velocity, and NOT that the mass actually increases!

The preceding provides, by the simple inclusion of the aether-space medium, the physical meaning for the

conventional interpretation of kinetic energy. However, we may gain additional insight by considering another perspective.

4.4 Does Mass Decrease with Speed?

Is it possible for mass to decrease with increasing speed? Theorist Harry Ian Epstein makes the argument that mass decreases with increasing speed. He proposes an alternate interpretation of Einstein's special relativity (ESR) based on "proper velocity" described as an observer's coordinate length divided by the proper time of the moving object. He reasons that mass decreases with increasing proper velocity, and approaches zero as the coordinate velocity approaches the velocity of light. Epstein makes *mass* and *time dilation* directly proportional to each other (Epstein, 2009).

Epstein's approach may well be consistent with ESR, but it is not consistent with reality. And it is not consistent with a physical meaning of energy—mass being one of its manifestations.

Nevertheless, there is an easy way to show how mass, conceptually, decreases with speed and tends to zero at ultrahigh speed. The explanation is based on the *Williamson particle theory*, which holds that all atomic matter is composed of confined photons (Williamson, 2008).

According to the new paradigm, all particles consist of electromagnetic loops (or loops of loops)—all particles are essentially confined photons. When these loops are complete, resonant, and harmonic they represent independent particles, such as the electron, muon, and tauon (and their antiparticle versions). However, when the electromagnetic loops are *not* complete configurations, then an interesting possibility arises. If a confined photon state is not sufficient in itself to complete a closed loop in space, then it may be possible to combine a number of such incomplete loops into a complete-and-stable combination. J. G. Williamson identifies these incomplete loops with quarks (Williamson, 2008).

His remarkable insight is that the proton, the neutron, lambda, sigma, Xi, etc., —the baryons—are manifestations of a triple photon confinement; and the pion, the kaon, eta, etc., —the mesons—are manifestations of a twin photon confinement. And the electron is a confined single-wavelength circularly-polarized photon (Williamson, 2008).

What all this means is that "mass" consists entirely of confined (localized) photons. I say "entirely" because the gluon strong-force carriers are not required; they are replaced by the simple condition of loop closure or completeness.

Now, consider such an electron; it is a confined single-wavelength self-orbiting photon; it is an electromagnet vortex. When at rest, the electron has only mass energy and no kinetic energy. Next, conceptualize this electron moving at lightspeed, the electron then becomes a cross-section of itself. (Ranzan, 2013) Whereas the confined photon normally follows the path of a tight loop whose diameter defines the size of the electron, the light-speed electron follows the path of an infinite-radius loop. The formerly looping photon is now forced to travel in a linear direction—and such an entity has NO mass. Remarkably the electron's mass has faded to zero—and without mass there can be no mass energy and no kinetic energy. This same argument applies the other atomic particles.

So, can we conclude that mass decreases with increasing speed (speed with respect to photon-conducted aether)? No. Something important has been left out.

What has been excluded is, of course, the energy input required to propel the particle or object and to induce acceleration. It is *that* additional energy that prevents the mass from decreasing in an actual situation. Whatever the frequencies of the confined photons, their frequencies increase in such a way as to maintain the constancy of the mass while the speed of the object increases. It then follows that kinetic energy increases as a function of increasing speed.

4.5 The Physical Interpretation of the Total Conversion of Mass to Energy

Returning to our conceptual lightspeed object; and let us ignore how the object acquired its ultimate speed. If an object were to move at lightspeed, it would have NO mass energy—its mass would be zero since the formerly looping photons would no longer be on a curving trajectory. And therefore, by definition, it would have no kinetic energy. However, because of the energy conservation law, we need to account for the lost mass energy. All the energy of the mass has gone into the energy of what are now unconfined photons. (But, of course, the energy was in those Williamson photons all along.) Each photon represents a packet of pure energy $E = hf = c/\lambda$.

What this means is that a "mass object" travelling at lightspeed is but a stream of photons and is equivalent to a 100% conversion of mass to radiant energy—and is no longer a mass object.

Although the conversion of mass to energy in this manner, with lightspeed objects, is purely conceptual, the converse is not. The conversion of photonic radiation into mass is a reality and commonly occurs with the

formation of electron-positron pairs.

4.6 Restoring the Physical Meaning of Time, Length, and Momentum

According to Einstein's theory, a *relatively* moving clock will appear to slow down and a *relatively* moving object will appear length-contracted. As for the object's momentum, it will appear to be non-classical. Such measures of time, length, and momentum are not necessarily real—not real in the sense that they depend on the motion of the observer rather than on the *intrinsic* motion of the clock and the object. Using Einstein's theory, different observers are permitted to make conflicting claims. But what about the corresponding observer-independent attributes?

Clock-time, length, and momentum may be expressed in real terms by simply replacing the conventional γ-factor, also known as the Lorentz factor, with the aether-referenced γ_B-factor. That is, one simply replaces the relative expression $\left(1/\sqrt{1-(\upsilon/c)^2}\right)$ with the intrinsic $\left(1/\sqrt{1-(\upsilon_B/c)^2}\right)$ in any equation of Einstein's special relativity theory. By using the intrinsic Lorentz factor with its aether-referenced velocity (arbitrarily labeled υ_B here) it is possible to formulate the real meaning for not just energy (as detailed earlier) but also for time, length, and momentum.

Relative time interval $\Delta t = \gamma \Delta t_o$ becomes real clock slowing $\Delta t_{real} = \gamma_B \Delta t_o$.

Relative length $L = \dfrac{L_o}{\gamma}$ becomes real contracted length $L_{real} = \dfrac{L_o}{\gamma_B}$.

Relative momentum $\mathbf{p} = \gamma\, m_o\, \boldsymbol{\upsilon}$ becomes real momentum $\mathbf{p}_{real} = \gamma_B\, m_o\, \boldsymbol{\upsilon}_B$.

It should be pointed out that not all lengths have equal status. Under Einstein's theory all lengths—spatial distances (empty space) as well as object lengths— may appear contracted. In the DSSU interpretation of the real world, only physical entities are subject to real length contraction.

5. Conclusion

The physical meaning of energy and mass, as well as the physical meaning of clock time, object length and momentum, depends on the ubiquitous presence of an aether-space medium—to which all motion is referenced and *in which ALL matter is conducted*.

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Notes

Note 1. *The Dynamic Steady State Universe* is the cosmology theory that holds that aether-space is dynamic and that aether-space expands and contracts ***regionally and equally*** resulting in a cosmic-scale cellularly-structured universe. It is a model based on the premise that all things are processes.