

Einstein's $E = mc^2$ and Dark Energy

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Abstract

Aristotle, Ptolemy, and geocentrism. Copernicus, Kepler and heliocentrism. Newton, the real estate stars and the universe ether. Einstein, Lemaitre and the “big bang” – homocentrism, hidden geocentrism. One has to decide: either at once all the mass of the world was created and so large one, or the mass is variable and the measure of inertia is $c^2 = \text{const}$, whatever being energy from all over the universe. The article shows that today, when we know that there are quasars moving away from us at a speed and 95% of the speed of light, Einstein's energy $E = mc^2$ should be considered as differential $dE = c^2 dm$. So since the corresponding binomial series for $v \rightarrow c$ is divergent, along with the solution of this differential equation goes an indefinite integration constant of infinite energy wherever we take the mass of rest m_0 as coordinate origin. This is where the dark energy lies. And when Perlmutter writes that “it has long been assumed that there must be some underlying symmetry that precisely cancels the vacuum energy” at least 10^{55} times greater than required by astrophysical data, Maxwell-Newton's postulate imposes by itself, while the unity of mass and vacuum could be shown by mathematical passage through the singularity of Planck's black-body radiation, that is, of particles without mass, into Maxwell-Boltzmann's distribution of velocities now of particles with mass.

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Introduction

“I think, therefore I am.”

That Descartes intuitive conclusion is really both first and last certainty of any human being—when we already know that the senses can deceive, and rational conclusions, based on sensory experience, can lead to going astray. Therefore everything should be checked. B. Russell illustrated this with a joke at the expense of inductive inference: everyone has been dying by now; it is likely that he also will, but this has not yet been proven. Yes, because that human “I think, therefore I am” comes from the deepest logic of Nature itself—precisely as the imperative of **inertia**: I am and I should be forever. Even in complete darkness, even if the whole world was gone: I am. However, if the day dawns, if one opens his eyes, he will realize that it is no accident that one of the first religious formulations was: and God said, let there be light, and there was light—the world was created. No matter how illusive or whatever it is—the world is. It's worth looking at: part by part, starting with the smallest detail, only one coordinate and another dependent on it. Well strictly mathematical. Descartes¹ gave the man and his world a coordinate system and a number in it—around which, even today, the lance is breaking.

First, the Earth was the center of the world because everything revolves around that “I am” walking on it. Then, though posthumously, Copernicus' work has been published: the movement of planets through the sky is an illusion; it is simpler to take the Sun as the coordinate origin. Kepler specified this simplicity as laws of motion of the planets, so Newton, using these descriptive laws and Descartes' coordinate system, formulated the famous “Mathematical Principles of Natural Philosophy”, which made possible for Lagrange by his “Analytical mechanics” to bring the application of coordinate system to the perfection even though neither the Sun is the center of the world, than the absolute system is bound to the stars of the real estate, to an ether that is immobile. And then Einstein denied the ether again from the deepest logic of Nature: it does not matter whether the current conductor moves in a magnetic field at a speed of $+v$, so it is an electromotor force, or a magnet at a speed of $-v$ while the current conductor is immobile, so it is a magnetomotor force; in short, the speed of light is the same in all inertial systems due to **symmetry**. Neither is absolute, everyone is relative. And with that idea he brought out his famous $E=mc^2$ as a simple consequence. However, relativity remained incomplete, Einstein was not able to explain his $c = \text{const}$, so this is a problem to this day: where a man who writes equations, from there the c_{max} , or, in fact, beginning from the mass that a man (hominini) chooses to be immobile. No more geocentrism—however, homocentrism. ^{2, 3}

Einstein's $\Delta E = c^2 \Delta m$

How, then, from that initial and only real certainty of “I am” to understand what “the World is” and how surely it is as exactly such one. Doubting even one's own body, one can pinch oneself and with the pain he feels to experience reality, but how about that world? If a magnet moves or an electrical conductor, it must be the same induction, he concludes intuitively, that reciprocity, and the rest only mathematically—pure logic. Einstein mathematically expressed this logic with the article⁴ “Towards the Electrodynamics of Moving Bodies”; nothing new in terms of kinematics, the Lorentz transformations were already known. New is Einstein's insistence that both length and time are relative and that this must be taken for reality. Why? Because magnet attracts, electricity kills, and that energy is transmitted through space by Umov-Poynting vector, by electric and magnetic fields also through vacuum. So when the transformation of coordinates is applied to the electromagnetic field, the expression for energy is obtained:

$$E' = E \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}} \quad (1)$$

In this case, E is the energy of electromagnetic waves in the coordinate system at rest and E' in the collinear coordinate system which moves in passing by at velocity v , and at the moment when their coordinate origins coincide.⁵

And it is precisely from the relationship of these two energies that Einstein begins his consideration in the following article with the famous question already in the title: “Does the inertia of a body depend upon its energy-content?”⁶ At the coordinate origin of a fixed system is a body that at one moment begins to electromagnetically radiate and has radiated the total energy of plane waves L , Einstein's mark by German **L**icht, light. Before the radiation began, the body had energy E_0 , and when the radiation took away part L of its energy, it has E_1 energy left. That's why

$$E_0 = E_1 + L \quad (2)$$

under the energy conservation law. The same law must also apply to a coordinate system that, relative to the first, moves at velocity v , Einstein marked the energy in that system with **H**, probably in accordance with the question in the title, everything is still **h**ypothetical here, German **h**ypothetisch. So

$$H_0 = H_1 + L \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}} \quad (3)$$

He further observes the energy balance of explicitly kinetic energy from the motion coordinate system. Before radiation, the index zero, it was

$$K_0 = H_0 - E_0 + C, \quad (4)$$

where C is a constant; Einstein takes into account that, in accordance with relativity, even the coordinate system that is taken to be fixed cannot be absolute and one cannot start calculating with a constant $C = 0$ from it. After radiation, index 1, the kinetic energy of the body is

$$K_1 = H_1 - E_1 + C. \quad (5)$$

So from the above equations it follows that by radiation the body lost energy

$$\Delta E = K_0 - K_1 = (H_0 - E_0) - (H_1 - E_1) = L \left(\frac{1}{\sqrt{1 - \frac{v^2}{c^2}}} - 1 \right). \quad (6)$$

At the time Einstein was writing this article, no one thought that there were other galaxies besides our Milky Way. All velocities in our galaxy, and therefore in the universe in general, are absolutely negligible compared to the light speed. Hence Einstein, developing into a binomial series the first term in the parentheses of the obtained formula, takes up only the second degree of the ratio v/c ,

$$\left(1 - \frac{v^2}{c^2} \right)^{-\frac{1}{2}} = 1 + \frac{1}{2} \frac{v^2}{c^2} + \frac{3}{8} \frac{v^4}{c^4} + \frac{5}{16} \frac{v^6}{c^6} + \dots \approx 1 + \frac{1}{2} \frac{v^2}{c^2}, \text{ and equation (6) becomes}$$

$$\Delta E = \frac{1}{2} L \frac{v^2}{c^2}. \quad (6')$$

Comparison with classical kinetic energy with the assumption that radiation energy goes at the expense of mass—and where it would otherwise from—one can conclude that

$$\Delta E = c^2 \Delta m. \quad (7)$$

Since then, much has been discovered in science on this trail. In 1916, Einstein published a general relativity theory, and the following year *Cosmological considerations* with that theory. In addition to the relativistic gravitational field equation, he postulates a cosmological constant λ to prevent the M-gravitational collapse of the universe. Eddington uses the solar eclipse in 1919 and records and reports that the light rays of the stars near the sun have indeed been deflected by gravity; Friedman in 1922 and then in 1924 gives a detailed analysis of the solution of the above equation: depending on the size of the mass M of the world and in general on the initial conditions, the universe may not only collapse but also expand or remain in a special equilibrium state, stationary and without a cosmological constant, λ -constant is redundant; Hubble, in 1926, that the Nebulae of our Galaxy are in fact other galaxies moving from us the further away the faster, 1929. And then Einstein gave up his cosmological λ -constant. At the same, it remained a mathematical indication of the so-called dark energy, which is still the problem today. In 1998 and 1999, one supernova from the southern hemisphere was observed first, then the second, the third, all of them moving with

acceleration from us, so what is it driving the universe to expand faster than according to Hubble's constant, calculated in the meantime also from Friedman's analysis?

Quasars with $z=7.5$ redshift are also known today, what, according to Einstein's relativistic equation for Doppler-effect, gives a 96.5 percent of the light speed. Therefore, the equation $\Delta E = c^2 \Delta m$ in these universe dimensions cannot be different than only differential

$$dE = c^2 dm. \quad (7')$$

Dark energy

So the question is up to what speed v is Einstein's relativistic mass valid

$$m = \frac{m_0}{\sqrt{1 - \frac{v^2}{c^2}}} \quad (8)$$

along with classical mechanics as its starting point

$$\begin{aligned} \Delta E &= \int_0^v F dl = \int_0^v \frac{d}{dt}(mv) dl = \int_0^v v d \left(\frac{m_0}{\sqrt{1 - \frac{v^2}{c^2}}} v \right) = \frac{m_0 v^2}{\sqrt{1 - \frac{v^2}{c^2}}} - \int_0^v \frac{m_0 v}{\sqrt{1 - \frac{v^2}{c^2}}} dv = \\ &= \frac{m_0 v^2}{\sqrt{1 - \frac{v^2}{c^2}}} + \frac{1}{2} m_0 c^2 \int_0^v \frac{d \left(1 - \frac{v^2}{c^2} \right)}{\sqrt{1 - \frac{v^2}{c^2}}} = \frac{m_0 v^2}{\sqrt{1 - \frac{v^2}{c^2}}} + m_0 c^2 \sqrt{1 - \frac{v^2}{c^2}} - m_0 c^2 = \\ &= \frac{m_0 c^2}{\sqrt{1 - \frac{v^2}{c^2}}} - m_0 c^2 = mc^2 - m_0 c^2 = (m - m_0) c^2 = c^2 \Delta m \end{aligned} \quad (9)$$

Up to what speed v ?

And from what speed must be taken into account the rest of this binomial series, the remainder as an integration constant, which is not really a constant, since it depends on the velocity of aspiring infinity for $v = c$,

$$\Delta E = c^2 \int dm = c^2 \Delta m + C \left(\frac{v^2}{c^2} \right) \quad (10)$$

The third cosmic velocity for us Earthlings is barely more than 70 km/sec, the Sun orbits about the center of the Galaxy approximately three times faster, and the greatest mutual difference of velocities in our Galaxy in relation to the light speed is measured by ratio of $1:10^3$, the square of that ratio is $1:10^6$. At that time, Einstein rightly held that all the mass M of the world was one and unique. Friedman was looking for a general solution to the relativistic gravitational field equation under this assumption: then only

what if that mass M is this big, what if it is so large? The army of mathematicians were calculating the Hubble constant from this general Friedman solution adjusting it with experimental measurements by different parameters. But at the end of the last century, persistent astronomers were in for a **dramatic surprise**.

Saul Perlmutter—later one of the three Nobel Prize winners for that discovery—published in 2003 an article “Supernovae, Dark Energy, and the Accelerating Universe”,⁹ and in the text under the subtitle **WHAT’S WRONG WITH FAINT SUPERNOVAE?** following: *The faintness—or distance—of the high-redshift supernovae in figure 3 was a dramatic surprise.*

From such a large redshift, it was clear that these supernovae were moving away faster than according to Hubble's constant; they are further away from the others, and therefore less visible. So where does this acceleration beyond any Friedman analysis go from, both in case the universe collapses and those in case it expands. Where did the energy for that acceleration come from?

Even if all the visible mass M of the world, as large as it is, converted to energy $E = Mc^2$, is not enough for such acceleration! A dramatic surprise, yes, just because one might otherwise imagine an inertial coordinate system at arbitrarily high speeds in formula (1)?

Yes, that's why.

Because “I think, therefore I am.”

I think, therefore the World is.

Or vice versa: The world is, therefore I think.

The solution lies in the relativity and symmetry of that universality, that Universe that has always been and will forever—by **inertia**. With the basic driving force in **relativity**, with the fundamental law in **symmetry**.

Dark energy is hidden in that $+C\left(\frac{v^2}{c^2}\right)$ of equation (10).

We have to decide: Or all the mass of the World is created of a sudden by a “big bang” and it is as big as it is, and with that mass Friedman's analyzes must apply. Or mass is variable and the measure of inertia is $c^2 = \text{const}$, whatever energy is from everywhere in the entire universe.

Maxwell-Newton postulate

Einstein, in his historical work, here in Equations (4) and (5), opted for the same constant C , tacitly in fact for the third coordinate system in which that constant would be zero. On a cosmological scale, however, if we are already to answer the question *How come the world exists*, that tacit assumption is incorrect. As seen from equation (10),

this constant is indefinite, depends on the mutual velocity of the coordinate systems, by the velocity difference it increases indefinitely because this binomial series is divergent, and consistent application of the relativity principle dictates that it can be zero at every m_0 masses. This integration zero of the Universe is relative, after all only in this way the postulate $c = \text{const}$ can be understood, only at the micro level $h\nu = m_0c^2$.¹⁰ Why would any mass m_0 , even if it be capitalized M , have the advantage of calculating c_{max} starting from it?

Why would there be a single “big bang” with the man's view on the cosmos, so that's where the beginning is of the entire world and of those distant supernovae from billions of years ago, before our solar system was created? No! The same force because of which, they say, the universe expands after the “big bang” with the perspective that after a while it may even contract, as according to Friedman's analyzes—everything depends on the initial mass, i.e. energy and in general initial conditions—the same force causes this extra acceleration of distant supernovae, the metric itself in the Universe. As the stars lose mass through radiation, **the space-time metric changes**, it would be said that it tends to flatten when it comes to a single star. And since a metric without mass is not defined, even flat space-time cannot be without mass: Euclidean metric is one where all masses are infinitely far away. Otherwise they all have an impact. When two giant black holes in a spiral collision lose, for example, 3 of the Sun's masses—as established by experimental observation of 2015—**the metric changes more drastically**. Most drastically, however, by creating a mass in an explosion of so-called the big bang, most drastically and most certainly at least at the beginning: by the propagation of spherical gravitational waves at the light speed. This expansion causes the acceleration of all the masses in its path that have been formed earlier—and even the former stars-candidates for future supernovae that have finally exploded and been spotted on Earth somewhere in the who-knows-where of the universe.

Considering the dramatic surprise mentioned above, as well as estimates that, despite the anisotropy observed in the cosmic microwave background, the universe is already almost flat, Perlmutter writes that a ratio of 7 to 3 would be a realistic estimate of the two opposing energies: the dark energy of vacuum versus the gravitational energy of mass—all from the point of view of the modern cosmological “big bang” model. But the calculations of quantum field theory (the standard elementary particle model) for vacuum energy give enormous density, at least 10^{55} times higher than required by astrophysical data. So below in the text under the subtitle **WHY NOT A COSMOLOGICAL CONSTANT?** Perlmutter concludes that both stars and galaxies *could never have formed* then, and we may *need some new kind of accelerating energy—a “dark energy” that, unlike λ , is not constant*. And otherwise, *it has long been assumed that **there must be some underlying symmetry** that precisely cancels the vacuum energy*.

And it is precisely this missing fundamental symmetry which corresponds to

MAXWELL-NEWTON POSTULATE of diamass vacuum-displacement:

No mass can be created anywhere, if the same amount of mass in the form of a diamass vacuum-displacement does not come out from that space.

And then there is no gravitational energy of mass **versus** enormous vacuum energy, which some mysterious force should accurately cancel out, bringing it to the right measure; than it is **symmetric** unity of mass, on the one hand and on the other, of the space-time metrics—by **inertia**. All because of relative zero of the Universe, because of **relativity**. So if in the universe celestial bodies move away from each other, it is because of the unique change both mass and space-time metrics as vacuum-energy. It is not on the one hand the finished mass is constant, and on the other, some mysterious vacuum energy represented by λ -constant. No, the λ -constant cannot be a constant because the metric changes. It can be found for a certain part of the universe in a certain universe period by an experimental observation of how much it is, so it fits into the equation, but that is not the point. The essence is the Maxwell-Newton postulate at the macro level. And at the micro-level, one unity again.

The unity of vacuum and the so-called elementary particles

At the end of the section on the Doppler-Effect in that historical work,⁴ Einstein calculates the power of electromagnetic radiation over the amplitude of the electric or magnetic field, the power is proportional to the square of the amplitude. And at the very end of the section he concludes: “It follows from these results that to an observer approaching a source of light with the velocity c , this source of light must appear of infinite intensity.” It is understood, of course, that this light source is in a fixed coordinate system, for example in one with the body that has radiated L energy for some time.⁶ Therefore, in a coordinate system arbitrarily conceived to be stationary.

And this is the paradox of homocentrism of which Nature warns with mathematics by exposing to us the boring infinity, as Hegel would say: attention, it is time to move again-and-again-quantity in a new quality! It is time to move into the micro world of new traits and new relationships, through which a different, true infinity opens—a completely indefinite infinity: mathematically, for example \mathbf{O}/\mathbf{o} . That when velocity tends to the light speed and amplitude tends to zero. This new quality is the quantum world, the unity of vacuum and mass: a vacuum in which all inertial coordinate systems are equally possible due to **relativity**—despite the fact that man even unconsciously imagines that his system is absolute; the quantum world of virtual energy quanta, where the collision of their coordinate systems at the light speed produces all possible particles, with one single condition—the preservation of **symmetry**. All possible particles from zero amplitude, from energy only virtual—just because somewhere some mass existed,

again so created by a collision out of pure virtuality; from the possibility which is forever and ever—by **inertia**. In short:

All the infinite multitude of the so called elementary particles, charged or uncharged, with or without mass, energy relevant or virtual etc is only, but the only mode in which vacuum can exist.¹¹

References and notes

1. He formulated his “Cogito, ergo sum”, in 1637 in **DISCOURSE ON THE METHOD**, but as early as 1628 he wrote in previous **PRACTICAL AND CLEAR RULES** that *it was not about what others thought or what we ourselves assumed, but about what anyone himself could see by spirit: that he exists and that he thinks*. Interestingly, the full title of this philosophical work in English translation is “Practical and Clear Rules of Spirit Conducting in the Study of Truth”, **of Spirit** unlike “Discourse on the Method of Rightly Conducting **One's Reason** and of Seeking Truth in the Sciences”.

Descartes began his education at a Jesuit college, a time, of course, after the Renaissance, but just then, bloody religious wars raged in France. So, although he writes that *it was not about what others thought*, is Descartes *Spirit Conducting* in the wake of church dogma of spirit and soul and after death, or is it nevertheless that intuitive observation the human urge from Nature's deepest logic—by **inertia**; intuitive, but also reasonable observation by a method that recognizes transience, i.e. **relativity** and because of it the necessary **symmetry** (reciprocity)—again from the deepest logic of Nature?

Why would it be impossible for such an interpretation of Descartes agree with church dogma if dogma is not dogma but metaphor, no matter how much does the religious service of this or that religious orientation insist on rigidity? And no matter that Descartes did not publish his work “The World or the Treaty of Light”, started in 1633, when he heard that the Inquisition had sentenced Galileo to life in house prison.

2. Milan D. Nešić: *In Cosmology, $c^2 = \text{const}$ Is the Measure of Inertia, Not Mass*,
<http://vixra.org/pdf/1812.0230v1.pdf>

3. Milan D. Nešić: *Universe, Inertia and Universal Constants*,
<http://vixra.org/pdf/1907.0112v1.pdf>

4. The formula on page 913 of the said Einstein article *Zur elektrodynamik bewegter Körper*, **ANNALEN DER FHYSIK UND CHEMIE**, 17, Seite 891-921 (1905), where the speed of light is marked with a capitalized V. Because of simplicity, I have adopted

$\varphi = \pi/2$ which does not affect further derivation, only the classical Doppler-Effect is ruled out, due to the symmetry of the Cos-function mutually canceling.

5. Calculated from the fixed system.

6. *Ist die Trägheit eines Körpers von seinem Energieinhalt abhängig?* ANNALEN DER PHYSIK UND CHEMIE, 323, 13, Seite 639–641 (1905)

7. It is not arbitrary that Einstein specifically denotes energy in one coordinate system, especially in another, while electromagnetic energy is denoted by the same letter in both coordinate systems. He should show that the energy conservation law also includes mass, so in equations (4 and 5) he did not indicate that the kinetic part of the energies E_0 and E_1 from equation (2) is equal to zero, thus assuming that the difference in kinetic energy before and after radiation—observed, of course, from the moving system—will go at expense of the mass. With the $c = \text{const}$ postulate, it cannot be otherwise, since once the energy was radiated, it remains the same by inertia. And because all inertial systems are equal, it is indefinite as long as it is in vacuum—until it is realized into some new mass. Or until one, because of his mathematical needs, in an attempt at some physical explanation, says: not this one, this coordinate system should be considered to be stationary, now this one radiates. In this case in Equation (1) E and E' change the place. And the formula for the Doppler-Effect remains the same because for $E = h\nu$ the energy ratio is proportional to the frequency ratio.

That is why it is important to beware of homocentrism, albeit unconscious assumptions of a quasi-absolute coordinate system. Because there is not only one mass that would, for example, radiate.

In cosmology, c^2 is a measure of inertia, not mass.

8. The article ends with the expectation that at a body with highly variable energy content, such as radium salt, this theory could be verified that inertia from one body to another transmits through radiation: as much as one body loses energy, as much loses mass, which another gets. Even here, there is no famous formula $E = mc^2$, which would convert all mass into radiation energy, which only with the discovery of a positron and annihilation with an electron will prove correct. But the very next year, in 1906, in the article *Das Prinzip der Erhaltung der Schwerpunktsbewegung und die Trägheit der Energie*, Einstein wrote: “If it is assumed that every energy E corresponds to the inertia E/c^2 , the contradiction with the elements of mechanics disappears, i.e. the center of gravity of the body as a whole remains fixed regardless of the internal exchange of energy by radiation between individual groups of atoms.”

9 Saul Perlmutter: *Supernovae, Dark Energy, and the Accelerating Universe*,

<http://www-supernova.lbl.gov/PhysicsTodayArticle.pdf>

10 Milan D. Nešić: *There is no Coordinate System without Mass,*

<http://vixra.org/pdf/1908.0204v1.pdf>

11. Of course, this does not mean that we should not classify particles that have been discovered or only made and even these imaginary, which even, according to theory, can neither be experimentally detected nor produced. We should; however, not with the intention of discovering the last one that would be the basis and the first constituent of all that exists—Higgs himself, they say, is angry that his boson is called God's particle; but with the hope that this or that classification may give us new logical relationships and opportunities for further research.

Because the world of mass and vacuum, reality and virtuality is unique.

This is theoretically already indicated; for example, the equality of the singular mass M in the black hole and all the energy of the gravitational field on this side of the event horizon whose equivalent is $-M$,

<https://arxiv.org/pdf/1608.05264v3.pdf>

Or by whirlwind of even virtual quanta of energy, say photons, in relationship with Maxwell-Boltzmann law of particle velocity distribution,

<http://www.wseas.us/e-library/conferences/2010/Cambridge/CFH/CFH-22.pdf>

This has already been proven experimentally by collision a laser beam with only one electron as a catalyst for thousands of pairs of electron-positrons, for example:

<https://arxiv.org/pdf/1009.0703.pdf>

Or <https://iopscience.iop.org/article/10.1088/1361-6587/aab3b4/pdf> etc.

And if it were proved that the passage of Planck's law of black body radiation through the singularity gives Maxwell-Boltzmann's distribution of velocities of particles with mass—how, with what connection between which parameters*—this would be the real proof of the unity of mass and vacuum; the real proof of the Schrödinger's wave equation, which by the DeBroglie's postulate is simply set up in analogy with the Maxwell's wave equation for light; direct evidence that Schrödinger's wave- and Heisenberg's matrix-formalism are two sides of the same coin—in the dialectical unity of human thought and the logic of Nature.

* See note 6 in the article *Universe, Inertia, and Universal Constants*

<http://vixra.org/pdf/1907.0112v1.pdf>