

Derivation of „rest mass energy“ $E = m_0 c^2$ violates logic of math

$E = m_0 c^2$ conceptually not intelligible

We are taught that according to the formula $E = m_0 c^2$ the rest mass energy of a US Penny (2.5 grams) is equal to about 2 million gallons of gasoline!

The annual US electricity consumption of 3240 billions kWh probably cannot be stored in 130 kg water!

Or 1 g represents 25 millions kW/h... Fantastic science fiction!

Mechanics, an introduction

Force is the undefined fundamental concept.

Force is not defined by $F = ma$ that is a natural law sketch in macrophysics and not a definition.

Mass means quantity of matter and is a dimensionless number. In atomic physics, quantity of matter is represented by **the** mass number A .

Inertia must be exorcized because it is animism. *Inert mass* is an untenable *homomorphism* that was invented by Descartes. The body in the presupposed vacuity cannot resist to moving forces by its laziness or inertia. Special relativity adds a new quality to inert masses: their inertia is velocity dependent!

The body is not lazy. There is no vacuum.

$\mathbf{R} = m\mathbf{a}$ is a real reaction force of a dielectric medium (“aether”). This medium is known, because we can measure its radiation, it is the microwave “background” radiation.

In **macrophysics** the erroneously so-called inertial forces are due to a dielectric cosmic medium. That this aether force depends only on mass and acceleration is an approximation. Think instead of irrational inertia about forces that at least in **microphysics** depend on the shape of the atoms, i. e., on their distribution of charges. Reactive aether forces depend on velocity, too.

There are no “apparent” inertial forces, these forces are real ones and are a proof for the existence of a reacting dielectric medium. .

A different configuration of \pm charges may also cause a different shielding effect.

Inert mass impossible

Exorcise inertia!

The analogue is air drag:

A vehicle may have air drag 1. Two vehicles coupled in series have air drag $< 2!$

Clearly, air drag is not an additive property.

Reality of the dielectric aether

Electromagnetic waves cannot propagate through a vacuum.

A vacuum cannot have qualities like electrical permittivity ϵ_0 and

magnetic permeability μ_0 . These qualities are of a *dielectric aether*!

Recall that the phase velocity squared of electromagnetic waves in the aether is:

$$c^2 = 1/\epsilon_0\mu_0; \quad \mu_0 = 4\pi \cdot 10^{-7} \text{ H/m} = 1.256 \cdot 10^{-6} \text{ Vs/Am}; \quad \epsilon_0 = 1/\mu_0 c^2 = 8,854 \dots 10^{-12} \text{ As/Vm}$$

Wave impedance is $Z_0 = \sqrt{\mu_0/\epsilon_0} = 376,730 \Omega$.

Back ground radiation is waving of the dielectric medium and not the remainder of the big bang that has never happened.

Fallacious derivation of the energy-mass conversion formula $E = mc^2$

Consider a single electron being accelerated in a linear accelerator. You need energy to accelerate the electron because **against a resisting force work must be done**.

The *inertia* or laziness of the electron according to Descartes and Euler cannot explain this resistance! The textbook definition of inert mass:

it is the measure of an object's resistance or reluctance to change a motion

is an ontological mistake.

Repetition: The so-called inertia of a body is not the intrinsic resistance of the object to change a state of motion but it represents the resistance of a dielectric medium. The object experiences an exterior resistive force!

Confused axiomatic of mechanics mixed up with fallacious derivation of rest energy $E = mc^2$

Relativistic mechanics claims that $\mathbf{F} \equiv d(m\mathbf{v})/dt$ is the definition of force, which is an error of epistemology. In the axiomatic of mechanics force is an undefined basic or fundamental concept.

Leibniz [lei] argued that to take into consideration exclusively the concept of an extensive mass does not suffice. According to *Leibniz* in 1695, it is necessary to apply the concept of force that is "very intelligible" despite it belongs to metaphysics. It is an irony of the history of physics that positivistic physics exorcised the intelligible metaphysical concept of force but not the also metaphysical but animistic and irrational concept of inert mass!

Conclusion: force is an undefined theoretical concept.

A defined concept is energy $E = \int \mathbf{F} \cdot d\mathbf{s}$

In classical mechanics $\mathbf{F} \approx m\mathbf{a}$ (a = acceleration) represents a law-sketch: For low velocities the erroneously so-called inertial force $m\mathbf{a}$ is the reactive force of a resisting medium. The magnitude of the force is the same for acceleration from 0 to 5 km/h and from 1000 to 1005 km/h! Obviously, this seems to be inaccurate.

A second error is to introduce a velocity dependent mass $m = m_0 \gamma$, where γ is the known gamma factor $\gamma = 1/\sqrt{1 - (v/c)^2} = c/\sqrt{c^2 - v^2}$.

The number of elementary particles of a body remains the same during locomotion, no increase of the quantity of matter happens. Mass does not increase with velocity but a resisting force!

A third error is the concept of inertia:

The bodies don't have an intrinsic quality of inertia that increases with velocity...

What happens physically? An increase of the velocity is accompanied by an increase of the resistive force a medium exerts on the body due to the motion through the medium.

A force that matches some experimental data can be expressed by $F \cong m a \gamma^3$. For this force $F \cong m a \gamma^3$ and likewise for a velocity dependent mass $m = m_0 \gamma$, we get the same expression for energy by derivation.

Now the work E that must be done by the accelerating force F is equal to the force applied times the distance moved: $\int_1^2 F ds$.

Regarding the fallacious ‘derivation’ of the energy of the rest mass $E = m_0 c^2$ you should pay attention to a **mathematical error**:

The energy or the work done of the force is:

$$E = \int_0^v m a \gamma^3 ds = \int_0^v m c^3 [1/\sqrt{(c^2 - v^2)}]^3 a ds = (\text{because } a ds = v dv!) =$$

$$\int_0^v m c^3 [1/\sqrt{(c^2 - v^2)}]^3 v dv =$$

$$= m c^3 [1/\sqrt{(c^2 - v^2)}]_0^v = m c^3 [1/\sqrt{(c^2 - v^2)} - 1/c] = m c^2 [c/\sqrt{(c^2 - v^2)} - 1]$$

Here, pay attention to the fact that the two terms of the resulting difference

$$E = [m_0 c^2 \gamma - m_0 c^2]$$

represent the values for the upper or final (here $v = v$) and lower or initial limit (here $= 0$) of the integral.

It is a question of mathematical logic that the terms for $v = v$ and for $v = 0$ have no physical relevance for themselves.

If the result of a definite integral (here it is an energy) is necessarily a difference of terms, then this difference is not a difference of energies but serves only to compute the energy.

Repetition:

The last term $m c^2$ is erroneously interpreted as *rest mass energy* because it is the outcome for the initial limit $v = 0$ of the definite integral. This is an error of mathematical logic.

Only the entire expression $E = [m c^2 \gamma - m c^2]$ represents an energy but not the terms of the difference themselves! (One can denote rest mass more precisely as m_0 .)

Analogy:

Find the length of the arc of the parabola $y = x^{3/2}$ between points $(x = 0)$ and $(x = 4/3)$.

The definite integral for length is:

$$L = \int_0^{4/3} \sqrt{1 + (dy/dx)^2} dx = \int_0^{4/3} \sqrt{1 + (9/4)x} dx.$$

Substitution $u = 1 + 9/4 x \rightarrow du = 9/4 dx$.

For $x = 0 \rightarrow u = 1$; for $x = 4/3 \rightarrow u = 4$

$$L = 4/9 \int_1^4 \sqrt{u} du = (4/9)(2/3) u^{3/2} \Big|_1^4 = (8/27) [8 - 1]$$

The “ $(8/27) \times 1$ ” part of difference has nothing to do with a length or part of length.

Next step in the conceptually confusing ‘derivation’ is the introduction of the term

rest energy:

If the initial velocity is $v = 0$, then the term for the initial limit of the finite integral has the value $E = m_0 c^2$. Since this term was calculated for $v = 0$, the term $m_0 c^2$ was baptized *rest energy*, meaning that it is an energy inside of the body, therefore a potential energy.

The entire term $\{m_0 c^2 \gamma - m_0 c^2\}$ is the work done by the accelerating force. This energy $E = [m_0 c^2 \gamma - m_0 c^2]$ was baptized *kinetic energy* which allegedly resides inside of the body and represents an intrinsic potential energy.

An expert of ScienceNet tries to answer the question:

Where does $E=mc^2$ come from? The relativistic kinetic energy is $E_{\text{kin}} = m_0 c^2 \gamma - m_0 c^2$. The term $m_0 c^2$ is independent of the speed of the particle, so we say that it is the 'rest energy', i.e. the energy a particle has even when it is not moving. The total energy of a particle is then:

$E = E_{\text{kin}} + E_{\text{restmass}}$ where E_{kin} is the kinetic energy and E_{restmass} is the rest mass energy.

The rest mass term depends only on the mass of the particle and relates to the energy in such a way that rest mass energy $E = m_0 c^2$. This is the mass-energy relationship...from this equation we deduce that mass must be a form of energy.

In this faulty deduction, and in many similar ones in text books, a non-existing kinetic energy $E_{\text{kin}} = m_0 c^2$ for a particle with speed $v = 0$ was transmuted into an intrinsic rest mass energy, e. g. a potential energy stored in the particle.

This is *hocus-pocus* and not a scientific derivation!

A gunshot excites the air and produces sound. Accelerating a body also produces an excitement of the resisting medium because there is no vacuum.

The relativistic partition: kinetic energy versus rest mass energy is wrong. In verity there is the following partition: The work done by the force F was converted partly into wave energy of the excited resisting medium, partly it was converted into potential energy of the body, namely deformation and heat.

The partition is unknown.

To the author, the confusing arguments with respect to the 'immortal' formula $E = mc^2$ show a horrible ignorance of logic and philosophy of science.

Also Ives showed that Einstein's derivation of $E = mc^2$ is fallacious because it supposed what is to prove, thus this is a classical *petitio principii*.

The simplest refutation of the derivation of rest mass energy $E = mc^2$

If the uncovered logical fallacies of the derivation of $E = mc^2$ are too laborious to read, a simple example can refute the derivation mathematically:

Take for the force not $F \cong ma \gamma^3$, but $F \cong ma v \gamma^3$.

Then energy

$$E = \int_0^v m c^3 [1/\sqrt{(c^2 - v^2)}]^3 v^2 dv = mc^3 \int_0^v ([v/\sqrt{(c^2 - v^2)}]) - \arcsin v/c \, dv = \\ = mc^2 [v\gamma - c \arcsin(v/c) + c \arcsin 0] = mc^2 [v\gamma - c \arcsin(v/c) + 0]$$

For this force-law there would be a **zero rest mass energy!**

If the rest mass energy is an intrinsic or potential energy, it cannot depend on the force law.

The result should always be $E = mc^2$.

Relativistic force formula physically impossible

If one supposes a velocity dependent increase of inert mass, then the formal relativistic derivation according to the vector calculus yields a physical impossible force:

$$\mathbf{F} \equiv d(m\gamma\mathbf{v})/dt \rightarrow \dots \rightarrow m\gamma \mathbf{a} + m\gamma^3 (\mathbf{v} \cdot \mathbf{a}/c^2) \mathbf{v}$$

In classical mechanics acceleration and force vector have identical direction. Not so in relativistic mechanics! Note please again that relativistic mechanics treats the second law of Newton as the definition of force: Force =_{def} the time derivative of momentum.

This is an epistemological error: A definition cannot be the foundation of physics.

Lex II is an empirical law. Force is a (logically) undefined basic concept of mechanics.

Energy is a defined concept: $dE =_{\text{def}} \mathbf{F} \cdot d\mathbf{s}$ Mathematics cannot create physics but is only a tool for physics. For the formal derivation $\mathbf{F} \equiv d(m\gamma\mathbf{v})/dt = m\gamma \mathbf{a} + m\gamma^3 (\mathbf{v} \cdot \mathbf{a}/c^2) \mathbf{v}$ there is no empirical indication...

Annihilation of electron and positron?

Commutation of electron/positron pair into radiation energy?

Misinterpretations of the Anderson effect!

See the article on the Anderson effect!

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