

REFUTATION OF REST ENERGY $E = mc^2$

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Abstract

Empiricists can be impressed only by experimental outcomes that counter the predictions of a formula. This is done here for fission of U-235:

U-235 + n (a low energy neutron) \rightarrow Ce-140 + Zr-94 + 2n + Q (208 MeV calculated)

Because the atomic sub particles p, e, n are not converted into energy, the binding energy of the daughter elements and the energy released (Q) can be only due to the binding energy of the parent element! The energy *imbalance* is obvious:

1784 MeV \rightarrow 1173 MeV + 815 MeV + 208 MeV

The formula $E = \Delta mc^2$ for binding energy is based on the mass/energy conversion formula $E = mc^2$ that relates energy to *inert rest mass*. Here it is shown that this relation is mistaken because applied to fission it violates the energy conservation bookkeeping rule!

This failure of the formula for rest energy is an indication that the derivation is fallacious. No wonder, the relativistic derivation of a velocity dependent mass is a *gedankenexperiment* of a collision: the collision is seen from two systems of coordinates that have different velocities. The requirement of momentum conservation for both systems of coordinates is only possible when the mass is also Lorentz transformed. This is a pure formal outcome in order to fulfil the *invariance* requirement.

There is no *rationale* why inert mass should increase with velocity. There is also no rationale why classical or relativistic inertia should proportionally increase with mass.

Mass spectrograph results are an experimental refutation of this claim: inert mass is not an additive property. If the inert mass of carbon C-12 is 12,000, the measured mass of Mg-24 is not 24,000 but 23,985.

Inertia is thought of as a reaction of the body against a moving force. This is impossible because a body in the presupposed vacuity cannot resist. The erroneously so-called inertial forces are not apparent forces but real forces.

Only if there is resisting medium, a resistance to motion is explainable by drag forces.

These drag forces depend on the number of constituent particles (*quantitas materiae*) and on the configuration of the building blocks of the atom. These drag forces are not conceptually related to intrinsic potential energy of particles or atoms.

A common relativistic derivation for rest mass energy $E = mc^2$ is based on *lex II* of classical mechanics. If the force is written as $F = m\alpha\gamma^3$, one gets for the energy the desired relativistic expressions for the masses and energies:

$$E = \int_0^v m \alpha \gamma^3 ds = \dots = mc^2[\gamma - 1] = mc^2\gamma - mc^2$$

The last term mc^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 a mathematical fallacy. Only the

entire expression $E = (mc^2\gamma - mc^2)$ represents an energy but not the terms of the difference themselves!

Introduction

Convertibility of mass into energy and *vice versa* is a by-product of Special Relativity. The essence of the conclusion is that any corpuscle contains a huge *potential* or *rest* energy according to the formula $E = mc^2$. This formula is based on the premise that the inert mass depends on velocity according to the expression $m = m_0 \gamma$, where $\gamma = 1/[1 - (v/c)^2]^{1/2}$.

But in the derivation of the velocity dependent inert mass there is surprisingly no regard to an intrinsic potential energy of a body.

A *gedankenexperiment* is done regarding two colliding bodies with masses m_1, m_2 and velocities v_1, v_2 . Conservation of momentum requires $m_1 v_1 + m_2 v_2 = m_1 v'_1 + m_2 v'_2$, where v'_1, v'_2 are the velocities after the collision.

Note now the *clou* of the derivation: Relativity theory requires conservation of momentum for the same collision but seen from a system of coordinates that has velocity u with respect to the first system of coordinates. Therefore the velocities must be transformed according to the Lorentz transformation. No surprise, momenta are not conserved this way!

But if a velocity dependent inert mass is invented, i.e., if also the mass is Lorentz transformed one, then it works!

Born is one of the many disciples of Einstein who uses also the collision *gedankenexperiment*.

Note very well that for this “as if” velocity dependent mass no *physical rationale* exists. The invariance requirement that all physical laws should have the same mathematical expression irrespective of the chosen system of coordinates is the premise of the derivation.

The derivations of the rest energy $E = mc^2$ of a body is based on the velocity dependent mass. All these derivations are fallacious, see below.

A cause for the huge potential rest energy according to $E = mc^2$ is never mentioned...

Einstein's derivation of $E = mc^2$ is fallacious

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

Inert mass does not exist

Inert mass itself 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!

For the physicist who likes experimental refutations, we can easily show that the main quality of inertia, namely that it increases proportionally with mass increase, is wrong.

Take carbon C-12, its mass is 12,000. C-12 consists of 6p + 6n + 6e, its mass number is therefore 12. Compare with Mg-24, it has 12p + 12n + 12 e. Therefore Mg-24 has 100% more inert mass than C-12.

But the outcome of mass spectrometry is $m_{\text{Mg-24}} = 23,985045$! For He-4 we get not 4,00 but 4,002604. That we measure inert mass for ions of the elements does not destroy the argument.

Obviously, measured inert mass has not the presupposed additive quality. No rationale for this behaviour of inertia is mentioned. We can expect that the velocity dependence of inert mass is not the same for all elements...

It seems to be impossible to explain causally the non-additivity of inert mass by decisions of inertia that depend on the element.

Think instead of irrational inertia at forces that depend on the shape of the atoms. Think that this force is not exactly proportional to the number of atomic constituents because a little shielding effect causes a decrease of the force. The analogue is air drag: A vehicle may have air drag 1. Two vehicles coupled have air drag < 2! Clearly, air drag is not an additive property.

The forces that cause the erroneously so-called inertial forces are due to a dielectric cosmic medium and are therefore of electromagnetic origin. This medium is known, because we can measure its radiation, it is the microwave "background" radiation.

Experimentally confirmed velocity dependent electron mass?

Take an electron e and the voltage U . The electron will have the energy eU . Let us equate this energy with the classical kinetic energy:

$$eU = mv^2/2 \quad \rightarrow \quad v = \sqrt{(2eU/m)}$$

with electron mass $m = 0,511 \text{ MeV}/c^2$ and $U = 1 \text{ MV}$ we get

$$v = c \sqrt{(2 / 0.511)} \sim 2c!$$

But experiments show $v \sim 0,87 c!$ Where is the mistake?

The expression for classical kinetic energy $E = mv^2/2$ is not the amount of energy that is stored inside of the moving body. Therefore "kinetic energy" is a misnomer. In reality work must be done to counteract the resistive force $F = ma$ of the cosmic dielectric medium.

This work is $E = \int ma \, ds = \int_1^2 mv^2 dv = m\Delta v^2/2$. Only a part of this energy was transformed into potential energy of the electron, the other part is gone into the medium. Think at a projectile in water, the projectile causes an accompanying wave in the water.

This effect is observable when electron-projectiles are shot through a crystal. The accompanying ether waves produce the well-known Laue-wave figures at the screen. (Duality of corpuscle and wave is nonsense!)

Conclusion: erroneously so-called kinetic energy is not defined by $E = mv^2/2$ but is the work done to counteract the resisting ether. The resisting force is only for "nonrelativistic" velocities $F = ma$. Otherwise the reactive force will depend on v^2 , and the "kinetic energy" will not be $E = mv^2/2$!

The discussion about the electromagnetic mass is an old one. A moving electron carries a field with it. This is the cause for a magnetic field. "Inertia" is therefore of electromagnetic origin. We don't know the formula for this force and interaction. But the introduction of a conceptually impossible velocity dependent electron mass is a failure.

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

Derivation of $E = mc^2$ impossible because inert mass and energy are conceptually incommensurable

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 electron's *inertia* or laziness according to Descartes and Euler cannot explain that 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.

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

Inert mass or $m = d_{El-A} A$ depends mainly on the mass number A but differs slightly on the atomic configuration that is specified by the chemical element (El) and its isotopes. The factor d_{El-A} is a coefficient that depends on the specific atomic structure of the atom. The value of this coefficient and the atomic mass number A determine the drag of the cosmic dielectric medium.

For carbon C-12 we set $d_{C-12} \equiv 1$. (Exactly speaking we can only measure the inert mass of the carbon ion.)

Inert mass $m = d_{El-A} A$ is in reality a shape coefficient d_{El-A} times A when a field exerts a force $\mathbf{F} \approx m\mathbf{a}$ on the atom during motion. *Inert mass* or $m = d_{El-A} A$ is just a number or a proportionality factor without a so-called dimension.

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. (In the axiomatic of mechanics force is an undefined basic or fundamental concept.)

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 an acceleration from 0 to 5 km/h and from 1000 to 1005 km/h! Obviously, this is inaccurate. We know for example that air drag is velocity dependent...

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. 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 $F \equiv m\gamma^3$. For this force $F \equiv m\gamma^3$ and likewise for a velocity dependent mass $m = m_0 \gamma$, we get the same expression for energy. Now the work E that must be done by the accelerating force F is equal to the force applied times the distance moved: $\int F ds$.

Regarding the 'derivation' of the energy of the rest mass $E = m_0 c^2$ you should pay attention to a mathematical error: The alleged derivation is:

The energy or the work done of the force is:

$$\begin{aligned} E &= \int^v m a \gamma^3 ds = \int^v m c^3 [1/\sqrt{(c^2 - v^2)}]^3 ds = (\text{because } a ds = v dv!) = \\ &= \int^v m c^3 [1/\sqrt{(c^2 - v^2)}]^3 v dv = \\ &= mc^3 \int [1/\sqrt{(c^2 - v^2)}]_0^v = mc^3 [1/\sqrt{(c^2 - v^2)} - 1/c] = mc^2 [c/\sqrt{(c^2 - v^2)} - 1] = \\ &= mc^2 [(1/\sqrt{1 - (v/c)^2}) - 1] = mc^2[\gamma - 1] = mc^2\gamma - mc^2 \end{aligned}$$

Here, pay attention that the two terms of the result

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

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 calculate the energy.

The entire term $\{m_0 c^2 \gamma - m_0 c^2\}$ is the work done by the accelerating force and not energy stored inside of the particle. That would be a potential energy.

So, many authors erroneously claim that the so-called kinetic energy $E = m_0 c^2 \gamma_{(v)}$ is identical with an intrinsic potential energy. In verity there is a partition: the work done by the force F is partly energy of the excited resisting medium, partly potential energy of the “deformed” body. The partition is unknown.

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 $m_0 c^2$. Because for $v = 0$ there is no kinetic energy the term $m_0 c^2$ was baptized *rest energy*, meaning that it is an energy inside of the body, therefore a potential energy.

It is a matter of logic that if the first term of the difference is a kinetic energy, then the second also must be a kinetic energy.

Not so for an expert of ScienceNet who tries to answer the question

Where does $E=mc^2$ comes 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 ‘deduction’, and in many similar ones in text books, a not existing kinetic energy for a particle with speed $v = 0$ was transmuted into a intrinsic rest mass energy, e. g. a potential energy stored in the particle.

This is *hocus-pocus* and not a scientific derivation! Obviously a potential energy in the body exists but the derivation above is wrong.

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!

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.

Because inert mass is a measure of the resistance of a medium exerted on the object due to motion through the medium, **inert mass** is **conceptually incommensurable** with **potential energy**.

Therefore inert mass and energy cannot stand in an equation with the *status* of a natural law and all alleged derivations must therefore be fallacious.

Annotation:

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:

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

In classical mechanics acceleration and force vector have identical direction. Not so in relativistic mechanics! Note please 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 one: $dE =_{\text{def}} \mathbf{F} \cdot d\mathbf{s}$

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...

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 $F \equiv ma\gamma^3$, but $F \equiv ma\gamma^3 v$.

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

$$= mc^2 [\gamma v - c \arcsin(v/c) + c \arcsin 0] = mc^2 [\gamma v - c \arcsin(v/c) + 0]$$

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 $E = mc^2$.

No empirical evidence for a rest mass energy $E = mc^2$

Annihilation of electron and positron?

The only alleged indication for a rest mass energy $E = mc^2$ is the so called “annihilation” of a “colliding” electron-positron pair with an energy release that corresponds to the mass/energy conversion formula:

$$e^- + e^+ \rightarrow 1,022 \text{ MeV } (\gamma\text{-ray})$$

because according to $E = mc^2$ the rest energies of both electron and positron are

0, 511 MeV. Note: The plus charge and the minus charge disappear! Obviously, in this explanation charge conservation is violated.

The reverse process is described as the conversion of γ -ray energy into masses of electron and positron:

$$\gamma\text{-ray } E \geq 1,022 \text{ MeV} \rightarrow \text{Ps} (= \text{electron} + \text{positron})$$

The production of positronium (Ps) is not due to a transformation of energy into inert mass that takes place in vacuity. This explanation ignores first of all that in this case the charges of both the electron and the positron are created out of nothing (*creatio ex*

nihilo), which is impossible. Instead of this misinterpretation there is every indication that positronium is not created but existed and can be liberated:

Positronium is assumed to be the building block of a dielectric aether that can be liberated with a γ -ray of $E \geq 1,022 \text{ MeV}$.

But this liberation of Ps is only possible in the presence of a “catalysator”, namely a molecule. The lattice of the molecule acts obviously as a buffer in order to bounce the positronium.

The energy necessary to liberate Ps is $2m_e c^2 = 1,022 \text{ MeV}$ but this is the binding energy of Ps in the aether and not the rest energy of the electron and the positron.

In the article REFUTATION OF REST ENERGY $E = mc^2$ it is shown that the energy-mass conversion formula $E = m_e c^2$ does not, and cannot, work.

Of course, annihilation of electron and positron pairs in the reverse process
 $e^- + e^+ \rightarrow 1,02 \text{ MeV} \text{ } (\gamma\text{-ray})$

are impossible. The disappearance of positronium cannot be interpreted as destruction but due to its ongoing binding into the positronium aether! The incorporation of the Ps causes an oscillation of the aether that we observe as radiation.

So, what is the meaning of Planck’s h in the usual presentation of the ongoing process:

$2h\nu \rightarrow \text{Ps}$

where $h\nu$ means a γ -photon with $E = 0,511 \text{ MeV}$. If the energy relation $2 \times 0,511 \text{ MeV} = 2m_e c^2 = 1,022 \text{ MeV}$ holds then it follows that for high energy radiation the energy can be treated as to be proportional to frequency $E = h\nu$.

If the energy of the radiation is $E \sim (\nu A)^2$ where A is amplitude, ν is frequency, then h is simply a constant of proportionality that expresses that $h \sim A^2 \nu$ because $E \sim (\nu A)^2 \sim h\nu$.

Conclusion: for γ -rays, Planck’s h expresses a relation between amplitude and frequency of the aether. h has nothing to do with an energy lump...

Annihilation of proton and antiproton

The inert mass of a proton has the magnitude of the mass of an electron times 1836. There is for example no experiment known, that the annihilation of a proton and an anti-proton releases energy of roughly 2000 MeV!

It is only known that the proton-antiproton annihilation yields

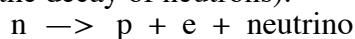


where \bar{p} means antiproton.

The neutrino – a stopgap to save $E = mc^2$

In the *Introduction to Particle Physics* <http://lectureonline.cl.msu.edu> one can read:

Neutrino must be present to account for conservation of energy and momentum (in the decay of neutrons):



In the decay of a neutron, energy and momentum were not conserved, the velocities of emitted electrons show large variations.

It has been found by experiment that the emitted beta particle has less energy than 0.272 MeV,

whereas 0,783 MeV represents the value according to $E = mc^2$
 (The mass difference $m_n - (m_p + m_e) = 1.008665 - (1.0077825 + 0.0005485) = 0.000841$ u
 corresponds to 0.783 MeV when it is converted according to $E = mc^2$)

Instead to give up calculations of binding energies according to $Q = E_{\text{released}} = \Delta mc^2$, a
 stopgap particle was invented:

The neutrino accounts for the 'missing' energy.

According to Haxton, W. C. and Holstein, B. R. Neutrino physics, Am. J. Phys. 68 (1)
 2000)

Pauli suggested...

*that an unobserved light neutral particle... (..the "neutrino" ..) accompanied the outgoing
 electron and carried off the missing energy that was required to satisfy energy
 conservation. Pauli offered this explanation tentatively as a "desperate remedy" to solve
 the energy problem.*

Both the observed large variations of the electron velocities and the discrepancy between
 observed and calculated energy indicate that the mass-energy conversion formula is wrong.
 Moreover, the neutron cannot be a nuclide with a constant binding energy and a constant
 spin.

The neutron undoubtedly represents a proton-electron combination that decays.
 The binding energies of proton and electron of different neutrons are different. Why?
 Most neutrons are fission products. Fission is the cause for different neutrons. According
 to Prout any atom is a ordered cluster of hydrogen atoms. Hydrogen is the building block.
 The H-atom consists of a proton and an electron that are magnetically coupled.

During fission at the site of fracture some hydrogen atoms are excited and energized
 differently.

This is the cause that they have decay at different time with different energies released.
 So, the neutron is identical with a excited hydrogen atom that decays: $n \equiv H^*$.

The decay process is written as

Fission process $\rightarrow H^* \rightarrow p + e + \text{energy } Q$

The different excitations of hydrogen atoms due to fission can explain why the released
 energy is not constant and why it is larger than the ionization energy of hydrogen.
 Moreover, because the mass of the excited H^* (or „neutron“) is unknown, its rest energy is
 not known and a calculation of the decay process is impossible.

Concerning neutron mass calculations:

Neutron mass calculations are based on nuclear processes that produce neutrons

1: $Mg-24 + \alpha \Rightarrow Si-27 + n + Q$

2: $Be-8 + \alpha \Rightarrow C-11 + n + Q$

3: etc.

There are at least 10 known reactions that produce neutrons.

Please see –Clarence Dulaney's Physics Page. What is a "Neutron"

<http://mywebpage.netscape.com/clarencedulaney/>

According to $E = \Delta mc^2$ the Q-energy (for example gamma rays) are converted into
 masses. Then it is impossible that for the calculated masses we get one and the same value
 which coincides with the official neutron mass $m_n = 1.008\ 664\ 916\ 37(82)$
 which one obtains from the arbitrarily chosen process $n + H-1 = H-2 + \gamma$ (2.2 MeV).

Conclusion:

- 1: There is no unique neutron mass calculable.
- 2: The calculation is due to the formula $E = \Delta mc^2$ which we cannot presuppose but we want to test!
- 3: The energy of the excited H^* is unknown.
→ No neutron mass! No Neutrino! No binding energy calculation possible!

There is also no need to introduce a neutrino spin in order to fulfill spin conservation. Of course the H^* has no defined spin. Eternally constant $\frac{1}{2}$ -spins of protons and electrons are *free creations of the human mind* and are of course not empirically confirmed. Magnetic moments of atomic sub particles must not be due to rotating charges.

Binding energies according to $E = \Delta mc^2$ erroneous

Calculations for the binding energy of atoms are based on the mass defect Δm , which is the measured mass m of the atom *minus* the masses of all sub particles (n, p, e).
The basic energy equation for the calculation of binding energy is:

$$E = mc^2 = \sum m_p c^2 + \sum m_e c^2 + \sum m_n c^2 - (!) \text{ binding energy}$$

We conclude that inert mass is not an additive property, because the mass of the sum of all atomic sub particles (p, e, n) is bigger than the measured inert mass of the atom!

Obviously, there must be a shielding effect for the atom. The analogue for this is air drag: a tractor-trailer unit exerts less air drag than the summed up air drags of the separated parts.

According to the formula above, a binding energy is only calculable if it is introduced with a negative sign (—) in the equation, otherwise the resulting binding would have a negative sign, which is senseless.

Objections to binding energy calculations:

1: The rest energy of the atom, namely $E = mc^2$, has the meaning of *potential* energy. Also the rest energies of all protons, electrons and neutrons: $E = m_p c^2$, $E = m_e c^2$, $E = m_n c^2$, are potential energies. Binding energy is by all means a potential energy! Therefore the total potential energy of the atom with inert mass m is

$$E = mc^2 = \sum m_p c^2 + \sum m_e c^2 + \sum m_n c^2 + \text{binding energy (and not } \textit{minus} \text{ binding energy!).}$$

The concept of rest energy $E = mc^2$ must be erroneous because the application of it according to the correct equation above yields a senseless binding energy with a negative sign.

2: Derivations of $E = mc^2$ are fallacious.

3: The calculation uses the rest mass energy of neutrons. There is no inertial mass of a neutron available. See above!

Empirical indications that calculated binding energies are meaningless:

1:

Li-3 and Be-5 would have negative binding energies, which is nonsense.

(Binding energy for Li-3: $-2,267$ MeV, for Be-5: $-0,154$ MeV)

<http://www.nndc.bnl.gov/masses/mass.mas03>

2:

No energy conservation in U-235 fission for binding energies according to $E = mc^2$

An example of the well-known U-235 fission is:

U-235 + n \rightarrow Ce-140 + Zr-94 + 2n + energy released.

According to the prevailing theory, the release of binding energy of the uranium atom during the disintegration process can easily be calculated due to the energy balance:

$$m_U c^2 + m_n c^2 = m_{Ce} c^2 + m_{Zr} c^2 + 2m_n c^2 + Q$$

When fission occurs, the disintegrated products have less inert mass than the reactants. This mass defect is allegedly convertible into energy in accordance with the equation:

$Q = E_{\text{released}} = \Delta mc^2$, whereas the energy released is a part of the binding energy E_B of the uranium atom.

Therefore:

The energy released = \sum (masses of reactants) c^2 – \sum (masses of products) c^2

In the textbook of Paus we find the following calculation:

$$E_{\text{released}} = c^2 \{ (m_{U235} + m_n) - (m_{Ce140} + m_{Zr94} + 2m_n) \} = 208.2 \text{ MeV} = Q$$

But if the calculated Q-value is in accordance with the observed one, the formula for rest mass $E = mc^2$ is not empirically confirmed!

The formula must pass another test, namely the balance of binding energies and kinetic energies.

Because the rest masses of protons, electrons and neutrons are not converted into energies, the binding energy of U-235 must equal the binding energies of Ce-140 and Zr-94 plus the energy release Q.

Now we calculate the **binding energies of U-235, Ce-140 and Zr-94:**

For example U-235 has 92 protons and electrons, 143 neutrons. The sum of their masses is 236.95899. The mass of U-235 is 235.04393.

We obtain from the mass defect the binding energy $E_B = 1784$ MeV. For Ce-140 the binding energy is 1173 MeV, for Zr-94: 815 MeV. So, the potential energy of U-235 is 1784 MeV.

	subunits	U-235		Ce-140		Zr-94		Ce + Zr	
	Mass	#	Mass	#	Mass	#	mass	#	mass
p+e	1.007825	92	92.7199	58	58.45385	40	40.313	98	98.76685
n	1.008665	143	144.239095	82	82.71053	54	54.46791	136	137.17844
Σm			236.958995		141.16438		94.7809		235.94529
m_{inert}			235.04393		139.90528		93.90614		233.81142
Δm			1.915065		1.2591		0.87476		2.13387
E_B [MeV]			1783.87		1172.84		814.83		1987.68

When the U-235 atom breaks into smaller pieces, according to $E = mc^2$ 208 MeV binding energy should be released.

Regarding the binding energies, surprisingly, the disintegrated pieces have $1173 + 815 = 1988$ MeV binding energy that is bigger than the binding energy of U-235 ! The energy balance is in disorder.

An U-235 binding energy of 1784 MeV produces a binding energy of 1988 MeV for the fragments *plus* an energy release of 208 MeV! So in uranium fission energy excess or energy creation of 412 MeV ($1988 + 208 - 1784 = 412$) violates the sacred energy conservation law. (Another question concerns the discrepancy of observed and calculated Q-values.)

The premises of this outcome are

firstly the underlying atomic model and

secondly the claim that inert rest mass represents an energy $E = mc^2$.

If the conclusion is wrong, there are two possibilities: either one of the two premises is wrong or both are wrong.

The table shows that the nuclei with their proton-neutron relations play a minor role. The main factor for the calculation of binding energy is inert mass.

It is remarkable that for U-235 the inert mass is larger than the mass number 235, whereas for Ce and Zr the inert mass is less than the mass number. This is the reason for the binding energy imbalance for fission mentioned above.

Therefore the conversion of the mass defect into binding energy is a failure.

Regarding the masses with respect to the mass number, two main trends are remarkable: up to Bi-214, the increase in inert mass is not a linear function of the increase in the mass number. For example: C-12: 12.000; O-16: 15.994915; ... Fe-56: 55.934939; Bi-214: 213.99869866; Po-214: 213.99518595.

If mass times acceleration is conceived as a resistive force of electromagnetic origin, then a shielding effect may be responsible for this pattern.

But approximately with Bi-215: $\underline{m} \equiv \underline{215.00183234}$ a trend breaking is obvious: for heavier atoms the inert mass is larger than the mass number.

In terms of the prevailing theory the mass defect becomes smaller and so does the binding energy.

A causal explanation for this trend breaking is not possible in terms of the current theory.

In terms of current theory it is well known that at the neutron number $N = 90$ a change in the nuclear shape occurs.

The transition from more spherical or more compact configurations to more prolate or 'dipolar' configurations must lead to a change in the 'inertial' reaction phenomena if the resistance is due to the electromagnetic reactive properties of a medium.

Fission of U-235 is a refutation of the electron shell of atoms

The electron shell and the particle transformations of the fission process are:

U-235	→	Ce-140	Zr-94
[Rn] 5f ³ 6d ¹ 7s ²	→	[Xe] 4f ¹ 5d ¹ 6s ²	[Kr] 4d ² 5s ²
6 p + 6 e	→	6 n (for Ce + Zr)	

Due to fission, all electrons of the U-235 shell structure [Rn] 5f³6d¹7s² tumble at the nucleus. The nuclei of Ce and Zr cannot manage the resurrection of the electron shells of Ce: [Xe] 4f¹5d¹6s² and Zr: [Kr] 4d²5s²!

The standard model cannot explain how 6 protons and 6 electrons of Uranium can be transformed into 6 neutrons of Ce + Zr!

Did Nobel price winners *Cockcroft and Walton* confirm experimentally $E = mc^2$? No!

http://nobelprize.org/nobel_prizes/physics/laureates/1951/cockcroft-lecture.pdf

The nuclear reaction considered was:

$p + \text{Li-7} \rightarrow 2 \alpha + 16,9 \text{ MeV released energy (calculated)}$,

where the Q-value of the released energy is according to the recipe $Q = E_{\text{released}} = \Delta mc^2$.

The claim is that the formula $E = mc^2$ is confirmed because the calculated Q-value is in good agreement with the observed 17,2 MeV.

Regarding the binding energies of both the reactants and the products we get the following result for the energy balance:

p	+ Li-7	→	2α	+ Q
Kinetic energy	Binding energy	→	Binding energy	Released energy
? 0,125 MeV?	39,2 MeV	→	54,6 MeV	16,9 MeV

Remarks:

No rest mass energies involved because all atomic sub-particles are conserved. Therefore the binding energy of Li plus the kinetic energy of the proton must be conserved!

The Nobel lecture of Cockcroft mentioned 125 kilovolts protons.

Obviously, the the energy balance is in disorder, because there is creation of energy. To balance energies, the proton should have the huge kinetic energy of 32,3 MeV.

A comment to:

A direct test of $E = mc^2$

Simon Rainville, James K. Thompson, Edmund G. Myers, John M. Brown, Maynard S. Dewey, Ernest G. Kessler, Jr, Richard D. Deslattes, Hans G. Börner, Michael Jentsche, Paolo Mutti and David E. Pritchard

Nature **438**, 1096-1097 (22 December 2005)

One example of these tests concerns the reaction

$\text{S-32} + n \rightarrow \text{S-33} + \gamma$

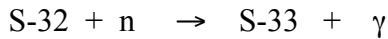
Masses: S-32 + n = 32,980736; S-33 = 32,971459; $\Delta m = 0,009277$

γ -radiation: $931,49 \times 0,009277 = 8,642 \text{ MeV}$.

Authors claim empirical evidence for $E = mc^2$ because the calculated value for the γ -ray is

in good agreement with data. But there is a second test necessary.

We must compare the binding energies and the γ -radiation energy for the reaction:



Because the sub particles p, n, e are not converted into energy,

the binding energy of S-33 plus the γ -energy is due to the binding energy of S-32 plus the kinetic energy T_n of the neutron only.

$$271,78 \text{ MeV (S-32)} + T_n (?) \rightarrow 280,422 \text{ MeV (S-33)} + 8,64 \text{ MeV } (\gamma)$$

There is an imbalance if the reaction is due to low energy neutrons! To correct this imbalance a kinetic energy of the neutron of $2 \times 8,64 = 17,28 \text{ MeV}$ would be necessary!

(Till now: Oct 23 2008, the kinetic energy of the neutrons is an open question for the present author.)

The second objection to this proof of $E = m c^2$ is the unknown inert mass of a neutron.

The mass of the neutron is a calculated one. This calculation applies $E = m c^2$. But different nuclear reactions yield different neutron masses. There is no „right“ neutron mass...

Appendix: Mass spectrography

Take for example the mass spectrograph of Bainbridge: Ions from a discharge tube enter a velocity filter. By crossed electric (E) and magnetic (B) fields all ions are filtered out except those with

$v_0 = E/B$. In the magnetic analyser (B_A) the ions are deflected according to the formula $m/q = r B B_A / E \dots$ where q is the charge and r is the radius of the deflection. Because v_0 is a low speed the measured masses are roughly the so-called rest masses m_0 .

Therefore, the mass spectrometer measures for one and the same velocity the "rest" masses of the atomic ions or of the sub-atomic particles p and e.

Therefore the results we get are the inert masses of ionised atoms. And we do not know exactly the inert mass of the neutral atom because we **cannot** simply **add** the inert mass of the electron to get the mass of the neutral atom.

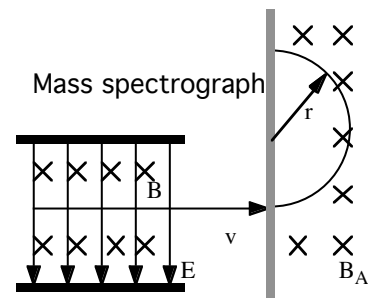
A look at the table for all masses of ionised atoms shows that **inertia is not an additive property**, there is no linear increase with increasing mass number A. If C has the relative mass 12.0 and He has 4.0026, the inert mass is not an additive property.

This outcome is inconsistent with classical theory of inertia, which stated that inertia (laziness!) is proportional to the amount of mass or stuff. Because it is supposed that the motion of the body takes place in vacuity, inertial forces must have their origin in the body.

Laziness of stuff is not the cause for erroneously so-called inertial forces. The cause of inertial forces is a resisting force of a dielectric medium.

The magnitude of that counter force depends on the shape of the body. Therefore this drag is not proportional to the number of the constituents of the atom. Think of a minute shielding.

It is historically interesting that in 1920 (!) Rutherford [23] theorized on inert mass similarly:



The fact that the mass of the helium atom 3.997 in terms of oxygen 16 is less the mass of 4 hydrogen atoms, viz., 4.032, has been generally supposed to be due to the close interaction of the fields in the nucleus resulting in a smaller electromagnetic mass than the sum of the masses of the individual components.

Rutherford never explained that the mass defect is due to binding energy but due to an electromagnetic resistance that depends non-additively on the number of components of the elements.

Tables list up the inert masses of the corresponding ions of the atoms – with one exception, namely for neutral hydrogen:

The value that you can find in textbooks and handbooks is a calculated one. It is wrong because it was supposed that inertia is additive.

It is not the case that $m(H^0) = m(p^+) + m(e^-) = 1.00727647 + 0.00054858 = 1.00782505$

QUANTITAS MATERIAE

OR THE NUMBER OF ATOMIC CONSTITUENTS IS CONSERVED:

Inert masses are not conserved. Inert mass is just a number without a ‘dimension’

Conclusion: In nuclear or chemical reactions the number of atomic constituents must be conserved. Creation out of the void or annihilation is impossible. This was meant with the conservation of *quantitas materiae* or quantity of mass.

Inert mass should not be confused with mass as amount of stuff. *Inert* mass is a measure of the resistance that a medium exerts on a moving particle or atom. This resistance depends on the atomic structure and is not an additive property. *Inert* masses are not conserved.

We cannot convert an *inert mass* defect into energy according to $E = mc^2$, this is ontologically impossible.

The author argues that Prout in 1815 was right claiming that all atoms are made up of hydrogen. So, the unit of *quantitas materiae* may be hydrogen. Carbon has 12 hydrogen constituents. During motion through the all-pervasive cosmic medium a force is exerted on the carbon atom (exactly speaking it is C^+). This force is for low velocities proportional to the acceleration \mathbf{a} .

By convenience we set the resistive force for carbon $\mathbf{R} = 12 \mathbf{a}$. Oxygen has 16 hydrogen constituents. Now the resistive force is empirically not $\mathbf{R} = 16 \mathbf{a}$ but $\mathbf{R} \approx 15.999 \mathbf{a}$ because resistance is not additive due to a minute shielding effect. So we can write

$$\mathbf{R} \approx d_{El-A} A \mathbf{a},$$

where A means the amount of hydrogen constituents or mass number and d_{El-A} means drag coefficient for the specific chemical element with mass number A .

Because the drag coefficient depends on the number of hydrogen atoms (A) and on the configuration of these atoms, isomers have different drag coefficients.

Take for instance C-14 and N-14 with their respective masses 14.003241988, 14.003074005. Both atoms have 14 hydrogen constituents but their configuration and therefore their drag coefficient is different: $d_{C-14} \neq d_{N-14}$

(Misnamed) *inert mass* or $m = d_{El-A} A$ is just a number or a proportionality factor without a so-called dimension. It depends mainly on the number of hydrogen constituents or mass number A but differs slightly on the atomic configuration that is specified by the chemical element (El). For carbon C-12 we set $d_{C-12} \equiv 1$. (Exactly speaking we can only measure the inert mass of the carbon ion.)

Again: The object experiences an exterior resistive force! But exactly speaking, inert mass is not this force, this resistance to motion. Inert mass is the quantification of the ether drag force. For the force, a force law is necessary, for example $F = ma$.

Inert mass or $m = d_{El-A} A$ depends mainly on the mass number A but differs slightly on the atomic configuration that is specified by the chemical element (El) and its isotopes. The factor d_{El-A} is a coefficient that depends on the specific atomic structure of the atom. The value of this coefficient and the atomic mass number A determine the drag of the cosmic dielectric medium.

From this it is comprehensible that inert mass is not an intrinsic or innate property of the atom, something like the laziness of the atom. Inert mass is a relational concept.

Haisch/Rueda/Puthoff [9] explained the role of inert mass correctly:

The m in ... $F = ma$ is nothing more than a coupling constant between acceleration and an external electromagnetic force...

To put it simply, the concept of mass may be neither fundamental nor necessary in physics...

Inert mass is only a name for a force coefficient or force proportionality factor times A . Obviously, *inert* mass is a misnomer because there is no innate property of *inertia* in the body!

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