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EPOLA: A New Approach to the Fine Structure of Matter and Space

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Article 3

THE "MASS - ENERGY EQUIVALENCE" DECEPTION THE SECOND GREATEST IN 20-TH CENTURY PHYSICS

1. The Anderson Discoveries and their Analogs. Carl David Anderson proved in 1932, that when a gamma-ray energy amount, or **quantum**, of no less than 1.02 million **electron-volts** (1.02 mega-electron volts, **1.02 MeV**) is **absorbed** in any point of space, then two nuclear particles, a free **positron** (discovered by him) and a free electron, **emerge** out of this point. The presence of the particles can be shown, e.g., by applying an electric field. The free (thus mobile) electrons are then moving toward the positive electrode, while the positrons move toward the negative electrode. Inversely, when a free electron meets a free positron, they may **disappear** in a point of space, out of which will then **emerge** at least two radiation quanta, of energy **summing up** to 1.02 MeV.

Analogous processes have been known to occur in crystals of sodium chloride (**NaCl**, table salt) and in similar ionic crystals. The NaCl crystal consists of positive sodium ions (**Na⁺**) and of negative chlorine ions (**Cl⁻**). Their charges are equal to those of the positron and of the electron, and **neutralize** each other in the crystal. The **binding energy** per ion pair is **8eV**, thrice the energy of a quantum of blue light. Hence, in the **pure** crystal, there is no absorption of visible light, nor of the ultraviolet of our environment. There are thus no free ions, the motion of which in an applied electric field would result in measurable conduction currents. The pure crystal is highly transparent and, as an electric insulator, it is probably the best after the best achievable vacuum space.



Carl David Anderson
1905 - 1991

As long as the ions are bound in the crystal, we cannot detect them directly with usual electrical or optical means that are energetically lower than the binding energy. When ultraviolet radiation of quantum energy not below 8 eV is absorbed in the crystal, a pair of sodium and chlorine ions is freed there per each absorbed quantum. The crystal becomes less transparent and slightly conducting. The opaqueness and conductivity are due to the appearance in the crystal of free ions of sodium and chlorine. After the cease of irradiation, the free ion pairs are slowly captured into crystal bonds and disappear to our detection. The crystal regains transparency and loses conductivity, while emitting radiation, that sums up to 8 eV per each ion pair caught into the crystal bonds.

The freeing of ions out of their bonds or their capture into bonds in the sodium chloride crystal is quantitatively described by $E=mc^2$. Here c is the velocity of sound in a large block of crystals (a **polycrystal**), E is the radiation energy (in multiples of the binding energy per ion pair), absorbed (or emitted) in the block, and m is the mass of ions, freed off (or caught into) bonds. The $E=mc^2$ equation describes such processes occurring also in all 17 (out of 20) alkali-halide ionic crystals that have the sodium chloride lattice structure (face-centered cubic, **fcc**), by substituting for c the velocity of sound in a polycrystal of the particular alkali halide.

The $E=mc^2$ equation is an easy transform of our formula $c^2=E_b/m_p$ for the propagation velocity c of elastic waves in a dielectric medium of the sodium chloride fcc lattice structure, in which the electrical charges of the two constituting lattice particles are those of the positron and of the electron. In our formula, E_b is the binding energy of the pair of lattice particles, and m_p is the mass of the pair. Substitution, in **SI** units, of $E_b=8eV$, and $m_p=58.4amu$, yields **3.6km/s**, the experimental value of sound velocity in a large block of sodium chloride crystals.

2. Physical Interpretation of the Anderson Results. The **appearance in space** of free electron and free positron (**epo**) pairs due to the **absorption** of a 1.02 MeV gamma ray quantum per each pair, and the **disappearance** of free **epo** pairs in space with the **emission** of radiation quanta, summing up to 1.02 MeV per each disappearing pair, are quantitatively describable by $E=mc^2$. Here c is the velocity of light in space, E is the radiation energy, in multiples of 1.02MeV, absorbed (or emitted) in space, and m is the mass of the electron positron pairs, appearing (or disappearing) in space.

The $E=mc^2$ equation is an easy transform of our formula $c^2=E_b/m_p$ for the velocity c of elastic waves in a dielectric medium of the sodium chloride **fcc** (face-centered cubic) lattice structure. Here E_b is the binding energy of the pair of lattice particles, and m_p is the mass of the pair. Substitution, in **SI** units, of $E_b=1.02$ MeV, and $m_p=2 m_e$ (electron masses), yields the velocity of light in space.

The analogy with the sodium chloride type crystals, the two lattice particles of which have the charge of an electron and of a positron, and applicability to the Anderson Results of formulae, derived for these crystals, suggests that *space contains electrons and positrons, bound in a face-centered cubic electron positron lattice - the epola, by an energy of 1.02 MeV per particle pair.*

When the bound electron positron (**epo**) pair **absorbs** the 1.02 MeV amount or *quantum* of energy, the two particles are **freed** out of their bonds in the epola space, and can be detected by our apparatus. Inversely, when a free electron and a free positron happen to meet, they may be caught into bonds in the epola space, and disappear to our detection. Their 1.02 MeV binding energy is then released, or **emitted**, in at least two radiation quanta.

The binding energy per *epo* pair in the epola is 300,000 times the energy of a quantum of blue light. Hence, in the **pure undisturbed** epola, (i.e., not containing atoms or freed nuclear particles, with no lattice **faults**, no mean thermal energies of lattice particles above those at a temperature of **3K**, no **de Broglie Waves** that accompany motions of nuclear particles in the wide channels between the lattice particles, etc.), in such an epola there is no absorption of radio waves, infrared, visible, or ultraviolet light, not of X-rays, not even of gamma ray quanta below 1.02 MeV. There are thus no free electrons or positrons, the motion of which in an applied electric field would result in measurable conduction currents. The pure undisturbed epola is the most **transparent** medium, and the best thinkable electric **insulator**, after the **imaginary** "absolutely empty" space.

As long as the electrons and positrons are bound in the pure undisturbed epola, we cannot detect them directly and individually with most electrical or optical means, which are energetically well below the binding energy. When gamma rays of quantum energy not below 1.02 MeV are **absorbed** in the epola, an *epo* pair is **freed** there per each absorbed quantum. The epola becomes less transparent and slightly conducting. The opaqueness to some radiations and the conductivity are due to the **appearance** in the epola of free electrons and positrons. After the cease of irradiation, the free *epo* pairs are slowly **captured** into epola bonds and **disappear** to our detection. The epola regains its unique transparency and loses conductivity, while emitting radiation, that sums up to 1.02 MeV per each *epo* pair **caught** into the epola bonds.

The **bound** epola particles become evident in all **known** observed physical phenomena, except those occurring **inside** nuclear particles. These are, in addition to the physical mechanisms of inertia, gravitation, electro-magnetic (EM) interactions and radiations, quantization of electron orbits in atoms, etc., also all the observed quantum and relativistic effects, that were postulated as axioms but never explained. The mechanisms of all such phenomena **can be** physically explained **only** as due to the existence of the epola. This ability raises the physical credibility status of the epola from "**suggested**" (see the 3rd paragraph of this Section) to "**proven**".

3. Misinterpretations of the Anderson Results. The Anderson Experiments were misinterpreted by relativists, who claimed that in them, radiation "**creates**" electrons and positrons by **turning into** these particles, and that electrons and positrons "**annihilate**" by turning into radiation energy. This allegedly 'follows' from $E=mc^2$, falsely presented by Einstein in 1905 as the formula of a "mass- energy equivalence".

To relativists, the misinterpreted Anderson results turned into the first "*direct experimental proof*" of Einstein's 1905 presentation.

However, during all those years since 1932, **nobody has ever created (or destroyed), out of (or into) "empty space", yet a single electron or a single positron**, even with the now available particle energies up to a million MeV. Hence a single MeV cannot create an electron **and** a positron out of that "empty space", if up to million MeV energies cannot create yet **one** of these particles. Appearance in space of an electron **and** a positron due to the absorption of the 1.02 MeV energy proves therefore that these **still indestructible** and uncreatable particles **must be existing in space**, bound in it by this energy.

Moreover, before claiming that particles are **created** by radiation out of empty space, an unprejudiced (and honest!) scientist would have looked for **physical** proofs that the particles were not in space **prior** to irradiation. Before claiming that particles **annihilated** into radiation, such a scientist would have looked for **physical** proofs that the particles are not in space **after** the emission of radiation. And, even if not able to find, he would not report "*So There Is No..*", like the "*So There Is No Malta*" ("**Malta Yok**") of the Turkish admiral, who could not find the island.

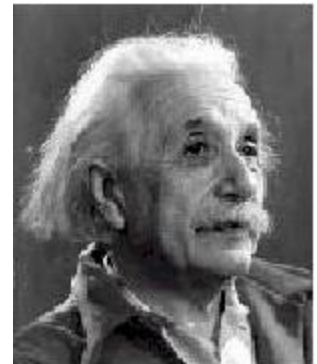
The unprejudiced and honest scientist would rather claim the honest **Ignoramus** Amendment, the "*we do not know (but may, in the future)*". He would look for **physical** analogies that could provide some suggestions, for or against. Like the one, that in NaCl crystals, the 8 eV ultraviolet radiation does not turn into ions, nor do ions turn into radiation; 8eV cannot create the sodium and chlorine ion pair; it can only free the pair out of their bonds in the crystal. Similarly, 1.02MeV may not be able to create the electron-positron pair, only to free the pair out of bonds in space.

Even at times when the honest scientist did not have any additional physical indications, he would rather wait for a clearer and better future instead of participating in the amock run against everything well established in the natural science of physics. A run to adjust the mythology of an absolutely empty space, to base on it the un-unifiable mathematical mysticisms of relativity and quantum mechanics, which "*nobody understands*" (as stated by Richard Feynman).

4. The Improper Interpretation of $E=mc^2$. Einstein derived this formula in 1905 from the Maxwell Equations, in a calculation of the radiation energy of an electron, moving in the electromagnetic (EM) field. Unfortunately, in introducing the mathematical ideology of relativity he smashed all rules and laws of the natural science of physics, that were standing in his way.

a. Einstein illegally generalized the applicability of the formulae, derived for electrons, to "ponderable masses as well", i.e., to atomic bodies, without any proof. Such auto-generalizations are legal in mathematics, but not in physics or in any other natural science, the objects of which do exist in nature. He explained his generalization by "...because a ponderable material point can be made into an electron by the addition of an electric charge, no matter how small." Well, it cannot. No piece of atomic matter, not even a single atom, can be made into an electron.

Einstein's statement wasn't good in 1905, and by 1935 it already was an obvious nonsense. Nevertheless, it was never corrected, and the illegal generalization is still used even in the most serious literature.



Albert Einstein 1879 - 1955

b. Einstein equated the radiation energy with any other energy, by saying: "The fact that the energy withdrawn from the body becomes energy of radiation evidently makes no difference, so..." However, different kinds of energy are not equivalent to one another; some kinds are "more equal". Thus, only a small part of thermal energy can be converted into mechanical energy. The energy of electric currents is most versatile, but only a small part of it can be converted into radiation energy, the "most equal" kind. By denying the difference between **kinds** of energy, Einstein played on the common misunderstanding of energy conservation. This law states that **if and when** one kind of energy is converted into another kind, then the converted **amounts** of energy are equal. Different **kinds** of energy are not equal, not replaceable.

c. Probably the worst Einstein did here to the natural science of physics is that he misinterpreted the $E=mc^2$ formula to say that it expresses the equivalence of mass and energy. By this statement he discarded at one stroke the Law of Mass Conservation, always considered as *"the most elaborately proven law of physics and chemistry"*.

Unfortunately, Einstein the mathematician and mathematics tutor did not realize that equations contain **amounts** only, and can thus equate amounts only. Equations cannot **equate kinds** of a physical magnitude **nor physical magnitudes** as such, simply because **equations do not contain them**. Hence, *an equation cannot replace mass by energy, nor any physical magnitude by another one*. Presentation of $E=mc^2$ as a mass-energy equivalence is thus improper. As wrong as would be such a presentation of the $E=mv^2/2$ equation for the kinetic energy of a body.

The truth is that in the $E=mc^2$ equation, m is the change in the amount of **mass of electrons** and other **nuclear** particles, present, appearing, and disappearing in space. This amount is equal to the amount of absorbed or emitted **radiation energy** E , divided by the squared velocity of light. The equality of these **amounts**, $m=E/c^2$, **does not mean that mass and energy are equivalent** or replaceable. Similarly, if you buy a loaf of bread for a dollar bill, then these two items are not equivalent or replaceable, because you cannot make bread out of the bill, or a dollar bill out of the bread. **Make**, not buy, sell, exchange, or outspeculate!

Last but not least: the Maxwell Equations were derived for the Faraday-Maxwell EM field. This field, with all EM interactions and radiations, was carried by a **material carrier, the ether**. Faraday's ether was an electrically neutral **dielectric medium**, of some discrete positively and negatively charged particles. Thus the Maxwell Equations with their c^2 may be hiding our $c^2=E_b/m_p$ formula, of which $E=mc^2$ is a slight transform. Derivations based on Maxwell's Equations may be "contaminated" by Faraday's ether, thus incompatible with "empty space" orthodoxy.

If you are interested to find out what the Epola model of space does and can do for the understanding of observed physical phenomena, I may recommend a close encounter with my book [Invitation to the Natural Physics of Matter, Space, and Radiation](#), World Scientific Publishing Co, 1994, (292 pages, ISBN 981-02-1649-1, can be ordered from Amazon.com or Barnes & Noble).

All mathematical derivations can be found in my Paperback, [The Electron-Positron Lattice Space, Cause of Relativity and Quantum Effects](#), Physics Section 5, The Hebrew University, Jerusalem 1990 (158 pages). The Paperback, as well as my popular Booklet, [The Story of Matter and Space](#), 1999 (70 pages) can be ordered from Robi Guttman - guttmans@netvision.net.il

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