On Low Energy Nuclear Fusion Chain Reaction (LENR) as a Plausible New Source of Carbon-free Energy

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Abstract

In this paper, the author explores LENR as a plausible new source of carbon-free energy and a non-mechanical engine.

All our experience of knowledge and my theoretical research in the field of fundamental physics surprisingly lead to the conclusion that any fundamental prime mover (sail, water wheel, steam engine, internal combustion engine, gas turbine, jet engine, nuclear reactor, electric current generator) - it is a nuclear fusion generator.

The modern scientific paradigm has exhausted itself. The quantum theory of the microcosm and the theory of the relativity of the macrocosm, (including the quantum theory of gravity), built on different postulated theoretical foundations, are fundamentally incompatible and incomprehensible to describe the movement of our United World.

The motion of matter, i.e. any change, including gravitational, electromagnetic and low-energy nuclear reactions LENR, the description of which is the task of science, can be further cognized solely on the based on a new scientific paradigm, postulating:

1. *The primacy of the movement* of our World as a way of its existence, as its *absolute attribute*, which is confirmed by all our experience.

2. Our World - Cosmos, which is in constant motion-change, - the only *absolutely non-local entity* that unites absolutely everything: material bodies, all types of substances, incl. Bose-Einstein condensate, physical fields and ether, physical vacuum, object and subject (observer), current and conductor, "moving body" and "perpetual motion machine" with power $N=h/t_P$ (absolute invariant) in one person and singular. The non-locality of our World is confirmed, in particular, by the experiments of Alain Aspect, John Clauser and Anton Zeilinger with entangled photons and the establishment of a violation of Bell's inequalities and modern experiments.

3. *The materiality of Cosmos lies in its motion*, which is a *non-mechanical* process of transformation of baryonic matter (BM) through neutrinos as a "displacement current" into "dark matter" (DM) and back, i.e. *material-energy induction*. If the electromagnetic part of our world moves as electromagnetic induction, then it is natural to assume, according to the principle of super -symmetry that its material part should move according to similar laws?!

Consequently, in the process of cognition, we observe and measure only the movement of matter, the integral measure of which is energy, and all the laws of motion of matter are the law of conservation of energy. We can change the motion of matter in the only way - by the corresponding motion of matter.

4. Cosmos motion is an absolute non-mechanical periodic *process of spherical runoff-source* (*convergence-divergence*) according to the Hubble H and Planck h factor, which is *the cause of formation, existence and motion of material bodies*. This material current, (occurring as "teleportation" at Planck's frequency), creates on the equipotential surfaces the tension-acceleration (difference of energy potentials), which causes any movement of matter.

5. The baryon mass formation of Cosmos, which is its fundamental movement and mode of existence, occurs as a volumetric spherical convergence of matter from all directions in 3-dimensional space and 3-dimensional time, when the density ρ_{bm} BM in a unit spherical volume $1m^3$ is equal to the volume derivative of H^3 (change in 3 directions of space) in the LT* dimension system :

$$\rho_{bm}=(H^3)'=dH^3/dV=3H^2 \qquad m^3s^{-2} \text{ in } 1m^{-3}$$

When the energy potential difference BM is equal to c^2, total *motion energy density* BM and DM Cosmos ("vacuum energy density" in terms of modern quantum theory) per unit volume per time $t_0=1/H$ is equal to:

$$\sum\rho_e=4\rho_{edm}=16\pi H^2c^2 \qquad m^5s^{-4} \text{ in } 1m^3 \text{ , where } \rho_{edm} \text{ - energy density DM.}$$

Cosmos energy in volume $1m^3$ in 1s, that is the power of Cosmos:

$$N=\sum\rho_e t_0=16\pi Hc^2=h/t_P \text{ - constant - absolute invariant} \qquad m^5s^{-4} \text{ in } 1m^3 \text{ in 1s}$$

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* LT - the system of dimensions of physical quantities "meter-second" (m, s), in which, for example, the dimension of electric charge is equal to the dimension of mass - m^3s^{-2}, the dimension of acceleration is equal to the dimension of energy-gravity potential - m^2s^{-2}, *Hubble parameter H_0*, equal to the rate of formation of BM, or the material current per unit volume per unit time, has the dimension m^3s^{-3} ($m^3s^{-2} \cdot s^{-1}$).

6. Cosmos as *the material-energy field* (MEF), is formalized through the MEF tensor: 3 components of the material field strength and 3 components of the energy field strength (energy induction) in the LT* (m, s) system of dimensions (using the mathematical apparatus of electromagnetism, quantum and relativity theories):

1) $\mathrm{div}\boldsymbol{M}=\rho$,

2) $\mathrm{div}\boldsymbol{E}=0$,

3) $\mathrm{rot}\boldsymbol{M}=-\partial\boldsymbol{E}/\partial t$,

4) $\mathrm{rot}\boldsymbol{E}=\boldsymbol{j}+1/c^2\cdot\partial\boldsymbol{M}/\partial t$,

5) $\iint\boldsymbol{M}dS=\iiint\mathrm{div}\boldsymbol{M}dV=\iiint\rho dV=m$,

6) $\boldsymbol{F}=m(\boldsymbol{M}+1/c[\boldsymbol{v}\times\boldsymbol{E}]$,

7) $\boldsymbol{j}=\boldsymbol{j}_m+\boldsymbol{j}_M=\sum\rho_e=16\pi H^2c^2$,

8) $N=h/t_P=\sum^V\rho_e T=16\pi Hc^2$ - Cosmos motion power (absolute invariant),

9) $hc=32H^2=32/t^2=\rho_e tt_Pc=\rho_e t_Pc/H=H\alpha\varepsilon_rc=\alpha\varepsilon_rc/t=R_y/R_\infty=H\alpha cnkT_r=4\pi G\lambda_{max}\alpha_W kT_r=32H^2\varepsilon_0\mu_0c^2$ - connection of all fundamental constants.

where $\boldsymbol{M}$ and $\boldsymbol{E}$–tensions of the material and energy fields, ρ–material and energy density, N–power Cosmos, h–Plank constant, t_P -Planck time, H -Hubble parameter, $\boldsymbol{j}=\boldsymbol{j}_m+\boldsymbol{j}_M=16\pi H^2c^2$-total material and energy "bias current", c - speed of light, hc - speed of transmission of action in LT, $t_P=2H/\pi c^3$- Plank time, Planck h, Hubble H, expansion time of the universe t, fine-strukture constant α, Rydberg R_∞, gravitational G, Boltzmann k, temperature cosmic microware background (CMB) T_r in K $\varepsilon_r=nkT$ - relict energy density CMB, R_y – Rydberg - unit of energy equal to the ionization energy of a hydrogen atom, λ_{max}– CMB wavelength with maximum intensity in m, v_{max} – CMB wave frequency in s^{-1}, ($\lambda_{max}\cdot v_{max}=c$), $4\pi G$ - conversion factor from LT to MLT dimension system:[LT]=$4\pi G\cdot$[1kg MLT], α_W - constant W.Wien, $\varepsilon_0=1$ - electrical constant, $\mu_0=1/c^2$- magnetic constant, c^2– material and energy potential in LT.

7. Elementary particles, bodies and fields are the corresponding *dynamical states* material and energy field (MEF), and *neutrino* is a material-energy "*displacement current*", matter in the convergence-divergence process from DM to BM:
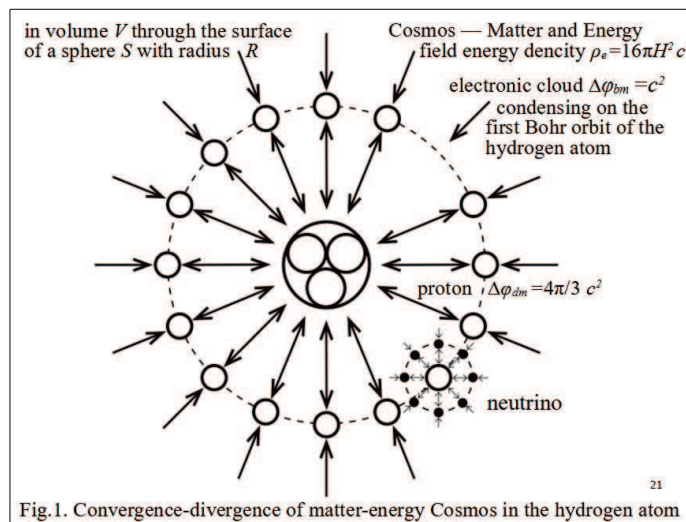

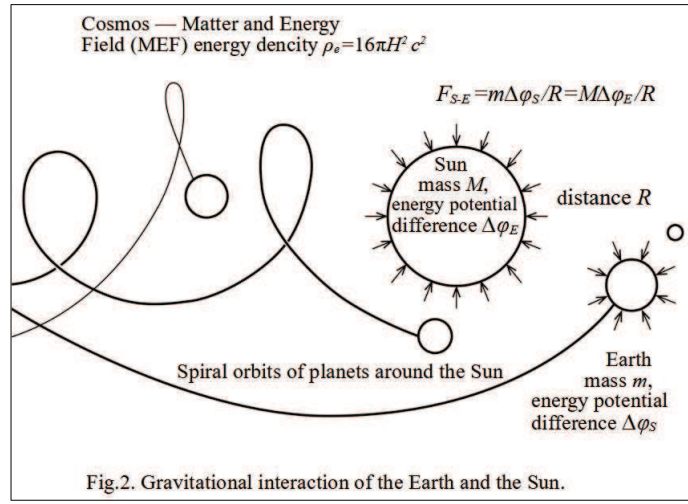Fig.1. Convergence-divergence of matter-energy Cosmos in the hydrogen atom

8. For the gravitational motion of two point bodies along an arbitrary trajectory, performing work $A=FR$, solutions of the equations are simplified, and the traction force is "gravity" at $v \ll c$ is equal to

$$\boldsymbol{F}=m(\boldsymbol{M}+1/c[\boldsymbol{v}\times\boldsymbol{E}]\approx\boldsymbol{m}\times\boldsymbol{M},$$

or, in its usual form, "the gravitational force" of bodies of masses m and M (subject to the absolute *principle of relativity*):

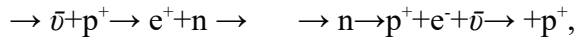$F=\boldsymbol{ma}=m(\varphi_2-\varphi_1)/R=m\Delta\varphi/R=mGM/R^2=mMh/4\pi R^2t_P=mM\tau/4\pi R^2=mE_t/4\pi R^2=mMt\rho_e/4\pi R^2=mM\rho_e/4\pi R^2H$,

where m and M – scalar quantities of masses of two bodies, $\boldsymbol{a}$ – acceleration-tension, $\Delta\varphi=(\varphi_2-\varphi_1)$ — energy potential difference, R–distance, radius, *resistance*, G-gravitational constant in MLT (in LT $G=1/4\pi$)

Cosmos — Matter and Energy Field (MEF) energy dencity $\rho_e = 16\pi H^2 c^2$

$F_{S-E} = m\Delta\varphi_S/R = M\Delta\varphi_E/R$

Sun mass M, energy potential difference $\Delta\varphi_E$

distance R

Spiral orbits of planets around the Sun

Earth mass m, energy potential difference $\Delta\varphi_S$

Fig.2. Gravitational interaction of the Earth and the Sun.

9. Physical and mathematical solutions of the motion of matter are found: for the hydrogen atom [5], Sun and Earth [6,7], Supernova SN1987A [8], CMB, gravitational waves and neutrinos [6,7,9], Mach's principle [10], connection of fundamental constants [11,12], falsifiability and experiments [7,11,12].

10. The movement of matter in the form of a chain reaction of cold nuclear fusion (LENR) as a reaction of β+ or β- decay according to the scheme:

$$\to \bar{\upsilon} + p^+ \to e^+ + n \to \quad \to n \to p^+ + e^- + \bar{\upsilon} \to +p^+,$$

when an antineutrino $\bar{\upsilon}$ acts on a proton $p+$ with the formation of a positron $e+$ and a free neutron n, which partially decays and is absorbed with the formation of isotopes and subsequent emission of the antineutrino $\bar{\upsilon}$, happens everywhere: in the Sun, in the Earth and other planets during the fusion of stars and "black holes" and supernova explosions after neutrino cooling[1], (such as SN1987A), in plants and animals[2] under the influence of neutrinos and antineutrinos formed , in particular, during β+ and β- - decay of radioactive isotopes ^{238}U, ^{235}U, ^{232}Th, $^{40}K_{19}$, $^{14}C_6$ (in the atmosphere),$^{56}Ni_{28}$, $^{63}Ni_{28}$ (artificial radioactive isotopes), with the synthesis of new elements and heat release.

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[1] After the explosion of SN1987A and volumetric neutrino cooling, a cold nuclear fusion reaction began in the supernova remnant. A month after the explosion, all the energy released by the explosion had already gone in the form of neutrino radiation, but SN1987A first fell in brightness, and then gradually increased in luminosity until it reached a peak on 05.20.1987 (after 80 days) to a magnitude of 2.9. By this time, most of the light came from another energy source: the decay of radioactive isotopes produced by the explosion. Supernova light curve accurately tracked the radioactive decay rate of ^{56}Co (+β decay $(p \to n + e^+ + \nu_e)$, $T_{1/2} = 77.27$ days) using it as an energy source. [14, 15, 16]

[2] in the body of a chicken, potassium $^{40}K_{19}$ can be converted into calcium $^{40}Ca_{20}$ by transmutation with hydrogen $^1H_1$ [20]

«By the end of the first month after the explosion of SN1987A, it was noticed that the radiation of the supernova is fueled by the radioactive decay of $^{56}Co_{27}$ formed in the central region of the explosion» [14]
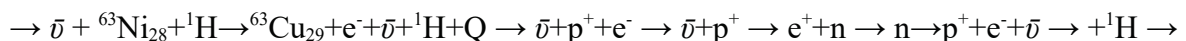
«The nature of the source of energy pumping has been established - the radioactive decay of the nuclide ^{56}Co, the product of the decay of another radioactive nuclide $^{56}Ni_{28}$ (–ε electron capture $(p+e^- \to n+\nu_e)$ and +β decay $(p \to n+e^++\nu_e)$, $T_{1/2} = 6.075$ days):

$$^{56}Ni_{28} \to {}^{56}Co_{27} \to {}^{56}Fe_{26}$$

$^{56}Ni_{28}$ is formed in the process at the moment or shortly before the explosion in the bowels of SN1987A» [15] The energy of the expanding matter of a supernova is not enough to explain the duration and energy of its outburst, which lasted several months. At the late stage, the supernova glowed due to the energy of the radioactive decay of ^{56}Ni with the formation of ^{56}Co and subsequent decay to stable ^{56}Fe [16].

"A number of experiments indicate that, in fact, neutrinos at low energies quite noticeably interact with matter" [18]

11. In terrestrial conditions, by analogy with SN1987A, one of the real nuclear chain reactions of β-decay $(n \to p+e^-+\bar{\upsilon}_e)$ along the main channel, when controlled by various methods, is feasible in the laboratory: passing hydrogen $^1H_1$ (tritium $^3H_1$, deuterium $^2H_1$, water H_2O) through $^{63}Ni_{28}$, (or ^{56}Ni) (artificial radioactive isotope of nickel, harmless to humans, serving as a source antineutrino (neutrino) and substance absorbing neutrons), at $t \sim 36.5 - 1200°C$:

$$\to \bar{\upsilon} + {}^{63}Ni_{28} + {}^1H \to {}^{63}Cu_{29} + e^- + \bar{\upsilon} + {}^1H + Q \to \bar{\upsilon} + p^+ + e^- \to \bar{\upsilon} + p^+ \to e^+ + n \to n \to p^+ + e^- + \bar{\upsilon} \to +{}^1H \to$$

where $^{63}Cu_{29}$ is a stable non-radioactive copper isotope.

It is possible, with appropriate protection from harmful radiation, a chain reaction of cold nuclear fusion through the following β⁻ decay channel when a $+p^+$ proton (hydrogen $^1H_1$, tritium $^3H_1$, deuterium $^2H_1$, water H_2O , etc.) is supplied to an antineutrino:

$$^{241}Pu_{94} \ (+p^+) \rightarrow \ ^{241}Am_{95} + e^- + \bar{\upsilon}_e \ (+p^+) \rightarrow \ ^{237}Np_{93} + \ ^4\alpha_2 + e^+ + n \rightarrow \ \rightarrow n \rightarrow p^+ + e^- + \bar{\upsilon}_e \rightarrow +p^+ \rightarrow,$$

where $\rightarrow \bar{\upsilon}_e + p^+ \rightarrow e^+ + n \rightarrow n \rightarrow p^+ + e^- + \bar{\upsilon}_e \rightarrow +p^+$.

12. With this chain reaction of LENR, along with the transmutation of the nuclei of elements and the release of the kinetic energy of the particles in the form of heat Q, it is possible to generate a high power electric current from emitted electrons, for example, using diamond semiconductors, in particular using carbon ^{14}C (beta-galvanic device, beta-voltaic generator) or others.

13. The movement of material bodies according to the modern scientific paradigm is a *mechanical* movement in space and time. In the presented theory, *the motion of matter is primary* periodic (with the frequency of Planck's time) *process of material-energy induction* due to the difference in energy potentials formed a absolute spherical sink-source (convergence-divergence). There is only one way to change the energy-gravitational potential difference of the moving Cosmos to create a "traction force" at a fundamental level - by "burning" the mass, i.e. turning it into "neutrino" radiation (neutrino field), which is what happens with cold nuclear fusion LENR.

14. Consequently, during a chain reaction of cold nuclear fusion LENR, several joint processes simultaneously occur in one material body - the "engine":

1) synthesis of new elements with the release of mechanical thermal energy,

2) generation of electric current as the movement of electrons arising during the reaction,

3) non-mechanical "anti-gravity" motion of the body in space and time. During the LENR reaction, the mass of the reactor-engine decreases due to its transformation into neutrino radiation, which increases the difference in energy-gravitational potentials in this place of space-Cosmos and the body-engine moves in the direction of a smaller difference in energy-gravitational potentials.

Knowledge of these processes will allow them to be used for practical purposes.

Conclusions and consequences are of a qualitative nature and serve for quantitative experimental confirmation of the theory. [19]

References
[1] H. Minkowski «*Space and Time*» 1908. **Minkowski's papers on relativity** (Minkowski Institute Press, Montreal 2012)
[2] J. C. Maxwell, «*A Dynamical Theory of the Electromagnetic Field* », **Philosophical Transactions of the Royal Society of London 155**, 459–512 (1865)
[3] A. Einstein (1916) *"The Foundation of the General Theory of Relativity"*. **Annalen der Physik. 354** (7): 769.
[4] A. Einstein. *Collection of Scientific Works in four volumes*. **Nayka** Moscow (1965-1967) vol.1, p242. (translated from Rus.)
[5] A.P. Nikitin, *Quantum Metaphysics: the Hydrogen Atom the Heart of the Universe!?*(ENG) https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2621215
[6] A.P. Nikitin, *Cosmophysics*. (RUS) http://vixra.org/pdf/1709.0296v1.pdf
[7] A.P. Nikitin, *New scientific paradigm*. **Problems of Universe Research**, (RUS) v.**38**, №1(2018) p217, http://scicom.ru/files/journals/piv/volume38/piv_vol38_issue1.pdf
[8] A.P. Nikitin, *GRT experiment: Supernova SN1987a* (ENG) https://papers.ssrn.com/sol3/cf_dev/AbsByAuth.cfm?per_id=2414981
[9] A.P. Nikitin, *Gravitational waves GW150914 и Supernova SN1987A*. (RUS) http://newidea.kulichki.net/pubfiles/160422002156.pdf
[10] A.P. Nikitin, *Mach's Principle and Principle of Relativity*. (RUS) **Metaphysics No.2(36)** (2020) p.148-159   http://lib.rudn.ru/35
[11] A.P. Nikitin, *Fundamental Connection Between the Planck and Hubble Constants* (ENG) https://papers.ssrn.com/sol3/papers.cfmabstract_id=3202664 , **Metaphysics No.4(26)** (2017) p.153-160. http://lib.rudn.ru/35
[12] A.P. Nikitin, *About the connection of all fundamental constants and Time*. (RUS) http://www.trinitas.ru/rus/doc/0016/001g/4180-nkt.pdf
[13] A.P. Nikitin, *Cosmophysics* (RUS). **Complex systems** №3(**28**) 2018. https://elibrary.ru/item.asp?id=36286910
[14] M. Hashimoto, K. Nomoto, et al., Light-curve models for supernova SN1987A in the LMC, Nature 328, 320 (1987)
[15] Имшенник В.С., Надёжин Д.К. Сверхновая 1987А в БМО: наблюдения и теория. **УФН** 156 в.4 1988 (RUS)
[16] Астрофизический модуль «Квант», *Наука и человечество* (1989) А.А. Логунов. М.: Знание, 1989. с.299-301 (RUS)
[17] Пархомов А.Г. Нейтрино малых энергий как причина аномалий в бета-распадах и ХТЯ, **Метафизика**(2020) №4(38) (RUS)
[18] Parkhomov, A. and Belousova, E. (2022) Huge Variety of Nuclides That Arise in the LENR Processes: Attempt at Explanation. *Journal of Modern Physics*, 13, 274-284. doi: 10.4236/jmp.2022.133019.
[19] A.P. Nikitin, Cold Fusion (CF) Chain Reaction and Non-mechanical Engine.(2022) (RUS-ENG) https://vixra.org/abs/2204.0144 https://vixra.org/pdf/2204.0144v1.pdf
[20] C. Louis Kervran and Biological Transmutations. *C. Louis Kervran and Biological Transmutations*. Retrieved 2019-08-01.