

Exotic Weapons of Mass Destruction & Martin Rees's "Our Final Hour" Memo by physicist Jack Sarfatti Sarfatti@pacbell.net , 6/24/03, 11:47 AM, page 1 of 36

Memorandum for the Record

Subject: Exotic WMD real or virtual?

* The "virtual particle" zero point vacuum energy release here discussed is much larger in principle than conventional nuclear fission of "real" uranium and plutonium and conventional thermonuclear fusion of "real" hydrogen into "real" helium. Background on this is in Sir Martin Rees's new book "Our Final Hour."

On Monday, June 23, 2003, at 03:58 PM, Cal State Physics Professor jfwoodward@juno.com wrote:

"Well, Jack, I'm glad to learn that you plan to take a closer look at the stuff I sent."

Yes, I need to read it slowly and carefully.

"Until recently I've thought that there was not much common ground in our approaches given your fixation on the local quantum vacuum aspects of the "cosmological constant" lambda field and mine on the essentially classical (but relativistically invariant) Machian aspects of gravity. Indeed, the only common ground, at superficial sight, seems to be the use of the "trick" of treating "field" quantities as "source" quantities to beat the "stiffness" problem (a trick, I note, that one can only get away with in gravity theory). But on reflection over the past few days, I think there is actually more common ground than just the use of this trick."

To explain, let me first note that the central issue in all "revolutionary" propulsion schemes is inertia. Without an understanding of the cause of inertia, no successful propulsion scheme is possible."

Agreed.

"It may not be possible anyway :-), but that's the pessimistic viewpoint. This is also true for wormholes and stargates, for the physical characteristic that identifies the "exotic" matter needed for their realization is negativity of its gravitational and inertial mass."

The modern post WMAP/Type 1a supernovae "precision cosmology" view since onnly Feb 11, 2003 on this is quite simple actually. Look at pp. 25 & 26 of John Peacock's "Cosmological Physics" for the basic idea. It is also in Turner's, Schwarzschild's and Perlmutter's articles in April Physics Today as well as in my review article <http://qedcorp.com/APS/Ukraine.doc> to be published in "Progress in Quantum Physics Research" Nova Scientific Publishers (2003).

Einstein's Equivalence Principle + Diff(4) covariance require that the equation of state for the zero point vacuum fluctuations of any local quantum field on a c-number curved spacetime background be of the form

$$w = -1$$

where w = zero point pressure/zero point energy density

Einstein's generalized gravity Poisson equation in weak field limit to make it look like Newtonian gravity is, in general:

Laplacian of potential energy per unit test particle mass of the "source" $\sim -(G/c^2)(\text{energy density} + 3\text{pressure})$

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In the special case of a $w = -1$ source, Einstein's local geometrodynamical field equation limits to

Laplacian of potential energy per unit test particle mass of the $w = -1$ "source"

$\sim +2(G/c^2)(\text{zero point energy density})$

Notice the sign conventions. Here a positive zero point energy density actually anti-gravitates because the pressure is negative and the pressure dominates when $w = -1$. This is unlike ordinary on mass shell matter with $v/c \ll 1$ and $w \sim 0$, and for on mass shell radiation where $w = 1/3$.

All quantum vacua have $w = -1$.

Ordinary vacuum does not gravitate it has vanishing zero point energy density.

"Exotic vacua" by definition have non-vanishing zero point energy density.

A positive zero point energy density is an exotic vacuum region of spacetime that is anti-gravitating "dark energy" and does the same thing as Kip Thorne's "exotic matter" and Hermann Bondi's "negative mass" or "negative matter". It is also what Alcubierre needs for his free float timelike geodesic "warp drive" which is essentially a refined form of the old Bondi-Terletsii (~ 1960) "vacuum propeller" (R. Coolidge) described by the late Robert Forward in his ~ 1991 "Negative Matter Propulsion" paper.

Similarly, a negative zero point energy density is an exotic vacuum region of spacetime that is gravitating "dark matter".

The dynamical problem is to compute the sign and magnitude of the zero point energy density of ALL quantum fields that together make the physical vacuum in any limited region of spacetime on a given scale of a scattering probe's 4-momentum transfer. One reference here is G.E. Volovik's "The Universe in a Helium Droplet" (Oxford, 2003)

This is where coherence of the macro-quantum vacuum plays a key role. I discuss that in my books and papers and the program is on-going.

As you know, there are several ways to deal with the origin of inertia. One is to simply assume that inertia is a primordial property of "matter". As such, it is beyond explanation and thus has no "cause". I don't believe that any sensible person should take this point of view seriously.

Agreed.

Then there's the "local action of some non-gravitational ZPF" approach championed by those we both know (though you know them better than do I). Here we agree that this approach is wrong.

You mean Bernie Haisch and Hal Puthoff primarily, also Alfonso Rueda and Trevor Marshall. Maybe Dan Cole?

We need to qualify here and make some vital distinctions that the above gentlemen are blissfully not aware of. I will call this the HRP approach.

1. Local zero point vacuum fluctuations can be reinterpreted in a global Machian way! This is the basic idea of Wheeler-Feynman as further developed by Hoyle and Narlikar and a few others.

The idea is that, at least for spin 1 photons, radiation reaction is equivalent to advanced action from future

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absorbers and there is a gauge symmetry from second quantized operator ordering ambiguity between classical radiation reaction and virtual zero point photons as explained by Peter Milonni in the "Quantum Vacuum".

2. Trevor Marshall's SED is founded on wrong ideas that quantum nonlocality is "irrational."

3. The HRP approach has no macro-quantum vacuum long range coherence in it. You need macro-quantum vacuum long range coherence to get the vanishing zero point energy density of the ordinary non-exotic vacuum that does not gravitate because its zero point energy density vanishes.

You also need this coherence because Einstein's c-number curved spacetime is a "More is different" (PW Anderson & Andrei Sakharov) emergent macro-dynamical object from the Goldstone phase ripple pattern in the vacuum coherence. Similarly, the unified ZPF "exotic vacuum" dark energy/matter local field $\Lambda_{zpf}(x)$ is emergent from the Higgs amplitude ripple pattern of this same vacuum coherence off-diagonal-long-range "order parameter".

It's like dropping a stone into a still pond. The "still pond" is the unstable globally flat Minkowski vacuum. The stone is to first approximation, primarily the spontaneous BCS macro-coherent pairing of the off mass shell virtual electrons and positrons near the edge of the Dirac-Fermi sphere in 3-momentum space under their mutual static Coulomb attraction that is the inflationary mechanism for spatially flat post-inflationary Hubble universes, e.g. Max Tegmark's "Parallel Universes" May 2003 Scientific American.

"I reject the ZPF explanation of the origin of inertia for two reasons: First, inasmuch as inertia allegedly arises exclusively from the local action of a local ZPF, there is no coupling to the distant "matter" in the universe -- whereas such coupling is the OBVIOUS (pace John Baez) observed fact of nature noted by Mach, Einstein, and now hoards of others."

This is not really a valid argument against HRP because of the Wheeler-Feynman reinterpretation of the local spin 1 photon ZPF as advanced absorber action from the "influence functional" of the future universe. It's a bit more subtle and I am over simplifying a little in this first round.

"Second, none of the ZPFs of non-gravitational fields displays the universal coupling to mass-energy of all types (that gravity does) that is required to recover observed inertial behavior."

That is also not a valid argument in the new paradigm I am presenting here because as Andrei Sakharov first glimpsed "through the glass darkly" in 1967 Einstein's c-number geometrodynamics of curved spacetime with the desired universal coupling of the equivalence principle is automatically built in. It is actually an emergent bottom -> up low-energy macro-quantum effective field theory that should not be quantized top -> down. To top -> down quantize gravity is redundant! Once more, I get the bonus of the unified dark energy/matter exotic vacuum local field $\Lambda_{zpf}(x)$ that at large scales > 10 megaparsecs is actually now observed as negative pressure dark energy of the accelerating universe with FRW Omega ~ 0.73 (from Type 1a supernovae data) + positive pressure "dark matter" with FRW Omega ~ 0.23 from several independent converging observational technologies like WMAP of the ~ 2.7 K CMB, gravity lensing (at smaller scales) etc.

"Your of the HRP ZPF argument, I gather, is based more narrowly on the specific nature of their ZPF, rather than Machian principles, for your lambda field you take to be a ZPF too, but of a different sort."

Again, I emphasize that the local ZPF idea and the Machian idea are the two complementary Faces of Janus because of the Wheeler-Feynman-Hoyle-Narlikar idea. It's like the Heisenberg vs Schrodinger formulations of quantum mechanics in 1925. There is a "canonical transformation" connecting the two ideas.

"Since you want to do "metric engineering" with your lambda field, you seem to accept that it must somehow involve inertia; but that seems only to be a tangential and inconsequential aspect of the field for your purposes."

There is no vague "somehow" it is already "exactly how" since I DERIVE the local geometrodynamical field equation

$$G_{\mu\nu}(x) + \Lambda z_{\mu\nu}(x) = -8\pi(G/c^4)T_{\mu\nu}(x) \quad \text{Sarfatti 2003}$$

+ supporting equations like a Diff(4) covariant Landau-Ginzburg equation in the $g_{\mu\nu}(x)$ background.

to be compared with Einstein's original 1915 equation

$$G_{\mu\nu}(x) = -8\pi(G/c^4)T_{\mu\nu}(x) \quad \text{Einstein 1915}$$

We see that my theory is exactly Einstein's theory for the ordinary non-gravitating "equilibrium vacuum" in G.E. Volovik's sense.

My new macro-quantum vacuum correction term is the "exotic vacuum dark energy/matter" term.

"Metric engineering" of star gate time travel machines and free float warp drives as well as "exotic vacuum WMD" (called "Doomsday" WMD by Sir Martin Rees in "Our Final Hour") mind you is precisely the local control of the

$\Lambda z_{\mu\nu}(x)$ zero point energy density field via Josephson weak links between the physical vacuum and superconducting materials that evade the spacetime stiffness barrier in the coefficient $G/c^4 \sim 10^{-33}$ cm per 10^{19} GeV on the RHS source term of the field equations above.

As a first approximation our local geometrodynamical field equation in 2003 AD is

$$G_{\mu\nu}(x) + \Lambda z_{\mu\nu}(x) \sim 0$$

The "vacuum propeller" field equation is simply its Diff(4) covariant divergence

$$G_{\mu\nu}(x)^{;\nu} + \Lambda z_{\mu\nu}(x)^{;\nu} \sim 0$$

$;\nu$ is the Diff(4) covariant partial derivative linear operator

$,\nu$ is the Newton-Leibniz calculus partial derivative linear operator

with the usual summation convention of tensor calculus on repeated upper and lower tensor indices.

$\Lambda z_{\mu\nu}(x)$ is a function of the spin 1 gauge force potentials $A_{\mu}(x)$ as in the Bohm-Aharonov effect whose first macro-quantum realization was the Josephson junction tunneling of real on mass shell electron pairs between two pieces of electrical superconductors at very low temperature.

Here one piece is the physical vacuum with macro-quantum coherence $\langle 0|e^{+(x)}e^{-(x)}|0\rangle$ and the other piece is an electrical superconductor with macro-quantum coherence $\langle g|e^{-(x)}e^{-(x)}|g\rangle$ that, like in a hologram, couple together in the local nonlinear Diff(4) Landau-Ginzburg equation as $|\langle 0|e^{+(x)}e^{-(x)}|0\rangle + K|g\rangle|e^{-(x)}e^{-(x)}|g\rangle|^2$ with K an impedance matching coupling coefficient analogous to what Ray Chiao needs in his "gravity radio." The physical vacuum is like the "reference beam" of the holographic universe and the metric engineering modulation pattern of the $A_{\mu}(x)$ field is the "object" or the "meaning of the message" with $\langle g|e^{-(x)}e^{-(x)}|g\rangle$ as the "scattered wave".

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The idea of the UFO "flying saucer's vacuum propeller" is that the saucer is not a passive test particle in a given external $g_{\mu\nu}(x)$ field but the intelligent metric engineer is able to actively induce its own local $g_{\mu\nu}(x)^*$ field so as to steer its own local self-created timelike free float geodesic with small tidal curvatures over the size of the saucer.

"Why is there common ground in these seemingly very different approaches?

Because the lambda field (be it your version, or some other version), very likely, really is the cause of inertia. Not because of the details of its local action as some sort of ZPF. Because of its global (dare I say it, "cosmological") properties. Note that the lambda field is an "exotic", "dark energy" field, so, treated as a "massive" source of gravity, it is negative. I won't dwell on the "weirdness" of this, for that turns out not to be the important point here. The important point involves what I call the "strong" form of Mach's principle: the gravitational induction of mass."

Yes, roughly speaking. The real source of inertia is simply the Sakharov "metric elasticity" from the macro-quantum vacuum coherence that is dominated at scales > 1 fermi by $\langle 0|e^{+(x)}e^{-(x)}|0\rangle$. We need to add full lepto-quark/gauge boson fields for smaller scales of the early universe of course. I am only now interested in the post inflationary universe > 1 fermi.

The idea here is that BOTH the local inertial field $g_{\mu\nu}(x)$ [and its first and second order derivative combinations of connection and curvature respectively] PLUS the dark energy/matter local field $\Lambda_{zpf}(x)$ emerge like Botticelli's "Birth of Venus" Triumphant <http://www.artchive.com/artchive/B/botticelli/venus.jpg.html> from the Sakharov - Anderson "More is different" macro-quantum coherent order $\langle 0|e^{+(x)}e^{-(x)}|0\rangle$. At this point in the development of my "Great Argument to justify the way of God to Man" (John Milton's "Paradise Lost") I resurrect John Archibald Wheeler's 1957 "Geometrodynamics" of "Mass without mass" and "Charge without charge" since now I have an effective strong short-range UV zero point energy induced effective gravity $G^* \gg G(\text{Newton})$ in the dark matter $\Lambda_{zpf}(x) < 0$ negative zero point energy cores of positive zero point pressure for $w = -1$. This solves the old Abraham-Poincare compensating stress problem for the stability of the spatially extended electron's self-charge as a Bohmian "hidden variable" that takes us directly to J.P. Vigiier's "tight states" potential WMD model that is being tested in Beograd and perhaps in Kiev?

The origin of rest mass of the lepto-quarks is simply the balance of spin 1/2 charges against the exotic vacuum "dark matter" cores $\Lambda_{zpf}(x) < 0$ of geometrodynamical multiply-connected micro-structures of $g_{\mu\nu}(x)$ in the sense of Wheeler's "Mass without mass" etc. Wheeler was crippled by $G(\text{Newton})$ so small - no longer so at small scales ~ 1 fermi. Once we have the lepto-quark rest masses, then use quantum chromodynamics to get the hadron masses as "bag models" of kinetic energy ~ 1 Gev as explained by Frank Wilczek.

"As you read through the stuff I sent (and a lot of the other published work I've done), you'll discover that Mach's principle figures into the derivation of the effects I've sought in the lab as a way of "separating variables" in a field equation so that the d'Alembertian of a scalar (gravinertial) potential can be isolated as the LHS of the field equations. This is done by noting that the strong form of Mach's principle requires that the total mass-energy of any local object be its gravitational potential energy arising from its interaction with all the other matter in the universe. From special relativity we know that the energy in question is just mc^2 -- where "m" is now a Newton-like "quantity of matter" rather than an inertial mass -- so the total gravitational potential (that I identify as "phi") must turn out to be c^2 . Remarkably, as can easily be extracted from Dennis Sciama's discussion of the origin of inertia, the condition $\phi = c^2$ turns out to be the condition required for inertial reaction forces to be

gravitational in origin.

What does this have to do with the lambda field? Well, gravitational potential energies produced by "normal" matter are invariably negative. But the mass-energies of "normal" matter are all positive. How can the negativity of normal gravitational potential energies be squared with the positivity of the mass-energies of normal matter so that the strong form of Mach's principle works? Well, you can simply assert that notwithstanding the negativity of local gravitational potential energies, when dealing with the action of matter at cosmic distances, the gravitational potential energies become positive. (That, in effect, is what I did for some years.) Or you can take the origin of inertia to be the lambda field. Since, as a source, it is exotic, the potential energies it creates in its action on normal matter automatically turn out to be positive -- as observed."

The sign of the zero point energy density $\Lambda_{zpf}(x)$ is a delicate dynamical matter for the individual quantum fields of spin 1/2 and spin 1. They all add up together and are controlled by the local macro-quantum vacuum coherence in a given region at a given scale. This depends on environment as well.

"Taking the lambda field to be the part of the gravitational interaction that is the cause of inertia (for the above stated reason) places some constraints on it. As I have discussed on a number of occasions over the years, "phi" (the total gravitational potential that gets multiplied by the "quantity of matter" m to give the energy that is related to the inertial mass of an object) must be a "locally measured" invariant -- exactly like the vacuum speed of light c (to which it is related by being c^2).

While this (and the resemblance of the lambda field understood as the origin of mass-energy to a Higgs type field) is interesting in its own right, I don't think it has much to do with the practical problems of rapid spacetime transport. Except that understanding the Machian aspect of the lambda field changes (perhaps) one's focus on how to deal with local problems. One thing, I think, that the Machian aspect suggests is that looking for ways to "bottle up" some local ZPF that allegedly is the source of the lambda field isn't the right way to tackle the problem. Why? Because even if some local ZPF were the source of the lambda field, its local density is on the order of the average cosmic normal matter density -- on the order of 10^{-29} grams per cc. That's one helluva bottling project.

What the Machian nature of the lambda field suggests instead is that what one really wants to do is to find a way to "decouple" local stuff from the action of all of the (chiefly) distant "dark energy" out there, for that is what's making its mass-energy positive. If that decoupling can be achieved by some means, what's left should have a negative mass, and it should be idiotically large. This is clear from the analysis of ADM elementary particles (that I included in MUSH and TWISTs). And, as an eminent colleague who is expert in the quantum vacuum I count a friend once pointed out to me, it's also true for any renormalized field theory of matter, for the "bare" masses of all fermions are formally negative and infinite. The trick to really exotic spacetime transport, in this light, is not how to bottle dark energy. It's figuring out how to decouple local real massive objects from the action of the lambda field treated as a source of gravity and the dominant part of chiefly distant

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matter, thereby exposing the gigantic amounts of exotic bare mass thereof. . . ."

I don't know what you really mean without seeing the mathematics in some kind of toy model. I seem to have much of the math needed at least in rough outline form in my <http://qedcorp.com/APS/Ukraine.doc>

A basic equation here is

$$\Lambda_{zpf}(x) = L_p^{*2} [A_0 - L_p^{*3} \langle 0 | e^{+(x)} e^{-(x)} | 0 \rangle + \langle g | e^{-(x)} e^{-(x)} | g \rangle]^{1/2}$$

A_0 is ~ 1 . Volovik calculates it dynamically in a simple toy model in his book.

$$L_p^{*2} = hG^*/c^3$$

$G^* \gg G$ (Newton) in some hyperspace models at scales $< \sim 10^{-4}$ cm

Note that my formula allows both positive and negative zero point energy densities $\Lambda_{zpf}(x)$ in the local zero point stress-energy tensor source field

$$t_{\nu\nu}(x)_{zpf} \sim (c^4/G^*) \Lambda_{zpf}(x) g_{\nu\nu}(x)$$

"Whether this sort of thing can actually be engineered, at this point, remains the merest speculation."

Here IMHO I disagree. I take it as a fact as credible as WMAP, Type 1a, Regge trajectory data etc. that flying saucers with $\Lambda_{zpf}(x)$ propulsion are in our skies now e.g. Paul Hill's book "Unconventional Flying Objects" and other reliable sources of data like the NIDS website. I could be wrong but I think not. In other words this is not a theoretical problem but a real problem of WMD in the sense of Sir Martin Rees's timely new book "Our Final Hour" and the danger seen years ago by Andre Sakharov as told to Lev Okun e.g. <http://qedcorp.com/APS/Austin.pdf>

Saul Paul Sirag and Elizabeth Rauscher can confirm that I wrote about this same problem that Sakharov worried about when I was working on strong short range hadronic "f-gravity" at Abdus Salam's ICTP in Trieste, Italy funded by IAEA in 1973-4. I mentioned the possibility of making small black holes in the lab even back then in a memo to USG DOD and lectured on it at the Nuclear Institute in Ljubljana. Fred Alan Wolf was with me on that trip.

"If the Mach effects I have predicted actually exist, there's at least a small chance that it can be done. If they don't exist, then we're back to bottling dark energy -- which I regard as a very dubious proposition. That is, even more dubious than exciting "wormhole term" Mach effects in the ways I've described in the literature. The only evidence that I would take seriously in this business is laboratory experimental results that can be replicated by others -- reported in a way that makes replication possible :-)

Anyway, we share the common ground of the lambda field it seems, though we look at it quite differently since we put it to different uses.

Your thoughts . . . ?

Jim Woodward

On Fri, 20 Jun 2003 13:45:24 -0700 Jack Sarfatti <sarfatti@pacbell.net> writes:

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James I do plan on getting back to you more on the two papers I recently have from you. :-)

On Friday, June 20, 2003, at 01:24 PM, Jack Sarfatti

On Friday, June 20, 2003, at 01:17 PM, Jack Sarfatti wrote:

Memorandum for the Record

From the Kiev paper by

[physics/0306072] Physical Mechanism of Nuclear Reactions at Low Energies <http://www.arxiv.org/abs/physics/0306072>

The physical mechanism of nuclear reactions at low energies caused by spatial extension of electron is considered. Nuclear reactions of this type represent intra-electronic processes, more precisely, the processes occurring inside the area of basic localization of electron.

Physics, abstract
physics/0306072
From: Yuri Arepjev <mickle@semicond.kiev.ua>
Date: Mon, 9 Jun 2003 16:49:32 GMT (151kb)

Physical Mechanism of Nuclear Reactions at Low Energies
Authors: V.P.Oleinik, Yu.D Arepjev
Comments: 14 pages, pdf, 2 figures
Subj-class: General Physics
Journal-ref: New Energy Technologies, 3(6), pp.17-23, (2002)

That resembles the J.P. Vigiery work with A. Dragic and Z. Maric in Beograd "On the Possible Existence of Tight Bound States in Quantum Mechanics" reported in Vol 126 of "Fundamental Theories of Physics" pp 349 - 356 Kluwer Academic Publishers 2002, which also has a related paper by me on pp. 419 - 430 immediately preceding Hal Puthoff's competing HRP type paper. Note, I did not have the present theory of macro-quantum vacuum coherence in my paper in Vol 126. I discovered the new ideas in <http://qedcorp.com/APS/> AFTER the demise of Joe Firmage's ISSO at end of 2000.

* The "virtual particle" zero point vacuum energy release here discussed is much larger in principle than conventional nuclear fission of "real" uranium and plutonium and conventional thermonuclear fusion of "real" hydrogen into "real" helium. This is controlled by c^4/G^* with $G^* \rightarrow G(\text{Newton})$ at scales > 1 fermi for sure

"real" = "on mass shell" in sense of globally flat quantum field theory Feynman propagator singularities in complex energy plane.

"virtual" = "off mass shell"

at The existence of simple physical mechanism of nuclear reactions
low energies, indicated
in this paper, implies that nuclear reactors are, in effect,

nuclear delayed-action bombs which will
blow up from time to time. Explosion of nuclear reactor may
take place because of casual short
circuit at an electric subcircuit, owing to which there appears
an intensive stream of free electrons.
This stream, having got for any reasons in nuclear reactor, may
initiate explosion of the reactor. It
follows from here that though nuclear stations may provide
mankind with cheap energy, atomic
energetics represents a very dangerous way of producing energy
(as well as the energetics using
controlled thermonuclear fusion). The only acceptable way of
resolving the energetic problem
consists in the use of nuclear reactions at low energies.

Excerpt from the Ukrainian paper below.

Subject: Sir Martin Rees's book "Our Final Hour" and relevant
current physics research

My book "Destiny Matrix" (November 2002 <http://www.1stbooks.com> &

Amazon et-al) discusses the 1999 - 2000 ISSO support of Professor

J.P. Vigiér's theoretical physics on "Tight Bound States in
Quantum Mechanics" that included a DeBroglie-Bohmian approach to what may
be mislabeled "cold fusion". Experimental work on this was done in
Beograd by A. Dragić and Z. Maric although there was not any
financial support othat work ever by ISSO. See Creon Levit's
note on this for more details in "Destiny Matrix". Astronomer Royal,
Cambridge Don, FRS, Sir Martin Rees's new book "Our Final Hour"
(2003) is of broader scope, but it supports some of what I say in

"Destiny Matrix" and adds much that I did not say in that book.

This work below from Kiev in the Ukraine appears, at least at a
first preliminary causal look, to be closely related to Vigiér's theory

that also fits in with my own theory of the extended electron
with a strong attractive exotic vacuum core $\Lambda_{zpf} < 0$ keeping the
spatially extended electron's electric charge repulsive self-energy stable
described in

<http://qedcorp.com/APS/Ukraine.doc>

That high 4-momentum transfers in electron scattering show the electron to behave like a point particle $< 10^{-17}$ cm is not contradictory to low energy structure with the electron size at the classical radius $e^2/mc^2 \sim 1$ fermi $\sim 10^{-13}$ cm.

The Vigier IV Conference in Paris <http://www.mindspring.com/~cerebroscopic/> should be interesting in this regard.

Curiously Oleinik below is also working on another of my long standing interests superluminal "Tesla" EM waves that may be similar to the EM "X-Wave" work of Waldyr Rodrigues Jr at UNICAMP in Brazil?

I have not yet had time to check out this hunch of mine. Jim Corum, previously at SARA then at Senator Robert Byrd's think tank ISR in West Va was also working in this area of "Tesla" physics with access to the Tesla Archive in Beograd.

*Note, I am not by any means endorsing this work. I am merely presenting it for discussion and debate. I have no opinion on its validity at the present time. The work must be considered carefully.

These are serious papers, not at all obviously "New Age Cargo Cult" like so many we have seen at ISSO and elsewhere. Knee-jerk debunking of "cold fusion" by Skeptical Inquirer should be avoided on this one.

Note also, partially expressed below in the Kiev paper, the idea of a generalized quantum theory of self-organization for OPEN systems not in equilibrium including not in Antony Valentini's "sub-quantal equilibrium" hence Dick Bierman's "presponse" i.e. "signal nonlocality". I introduced that idea as early as 1996 as a generalized quantum theory "back-action" "post-quantum theory" at the Tuscon II Conference published in the Abstract Proceedings. This idea was also published in Volumes 97 and 126 of Kluwer Academic Publishers Series "Fundamental Theories of Physics", i.e.

"Beyond Bohm-Vigier Quantum Mechanics" pp. 403 - 410 "Causality and Locality in Modern Physics" Vol 97 (1998)

"Progress in Post-Quantum Physics and Unified Field Theory" pp.

419 -

430, "Gravitation and Cosmology: From the Hubble Radius to the Planck Scale: Proceedings of a Symposium in Honour of the 80th Birthday of Jean-Pierre Vigièr" Vol 126 (2002).

i.e.

[physics/0306073] Information Field and Superluminal Communication <http://www.arxiv.org/abs/physics/0306073>

Physics, abstract
physics/0306073
From: Yuri Arepjev <mickle@semicond.kiev.ua>
Date: Mon, 9 Jun 2003 16:56:49 GMT (163kb)

Information Field and Superluminal Communication
Authors: V.P.Oleinik
Comments: 14 pages, pdf
Subj-class: General Physics

"The field of scalar and vector potentials in electrodynamics is shown to represent an informational field capable of superluminally transmitting a signal (information) with no energy and momentum transfer. This conclusion strictly follows from Maxwell's equations for electromagnetic field interacting with electric charges and currents in vacuum, without resort to any additional hypotheses. That superluminal communication is possible is seen from the fact that the own field, generated by particles and inseparable from them, transforms the environment into a special physical medium which is capable to instantaneously transfer a signal (information) about any changes, happening to a particle in the region of its basic localization, to arbitrarily large distances. The phenomenon of superluminal communication is caused by the non-local connection of scalar and vector potentials with the electric and magnetic field strengths. The basis for the mechanism of superluminal communication considered in this work is the

Aharonov-Bohm effect indicative of the field of electromagnetic potentials as a real physical field, which directly influences the behaviour of electron waves. The conclusion is made that in quantum systems superluminal signals occur constantly, in any quantum processes. The occurrence of superluminal signals is due to the space-time symmetry breaking of a special kind, consisting in that the equations for potentials do not possess relativistic invariance though Maxwell's equations for the field strengths are Lorentz-invariant. The results presented do not contradict the physical principles underlying special relativity and confirm the fundamental conclusion, made for the first time by de Broglie, that gauge invariance is not an absolute law in physics"

*A look at Martin Gardner's 1976 "Magic and Paraphysics" reprinted from MIT Technology Review in "Science, Good, Bad and Bogus", as well as Robert Anton Wilson's "Cosmic Trigger" shows that the idea of a nonclassical quantum "informational field capable of superluminally transmitting a signal (information) with no energy and momentum transfer." was explicitly an idea I independently introduced into public scientific discussion 30 years ago.

BTW Spontaneous broken EM gauge symmetry is essential to the theory of the BCS electrical superconductor.

On Friday, June 20, 2003, at 05:13 AM, Gary S. Bakkum wrote:

[physics/0306072] Physical Mechanism of Nuclear Reactions at Low Energies <http://www.arxiv.org/abs/physics/0306072>

"The physical mechanism of nuclear reactions at low energies caused by spatial extension of electron is considered. Nuclear reactions of this type represent intra-electronic processes, more precisely, the processes occurring inside the area of basic localization of electron."

Physics, abstract
physics/0306072
From: Yuri Arepjev <mickle@semicond.kiev.ua>
Date: Mon, 9 Jun 2003 16:49:32 GMT (151kb)

Physical Mechanism of Nuclear Reactions at Low Energies
Authors: V.P.Oleinik, Yu.D Arepjev
Comments: 14 pages, pdf, 2 figures
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"The physical mechanism of nuclear reactions at low energies caused by spatial extension of electron is considered. Nuclear reactions of this type represent intra-electronic processes, more precisely, the processes occurring inside the area of basic localization of electron. Distinctive characteristics of these processes are defined by interaction of the own field produced by electrically charged matter of electron with free nuclei. Heavy nucleus, appearing inside the area of basic localization of electron, is inevitably deformed because of interaction of protons with the adjoining layers of electronic cloud, which may cause nuclear fission. If there occur "inside" electron two or greater number of light nuclei, an attractive force appears between the nuclei which may result in the fusion of nuclei. The intra-electronic mechanism of nuclear reactions is of a universal character. For its realization it is necessary to have merely a sufficiently intensive stream of free electrons, i.e. heavy electric current, and as long as sufficiently great number of free nuclei. This mechanism may operate only at small energies of translational motion of the centers of mass of nuclei and electron. Because of the existence of simple mechanism of

nuclear
reactions
at low energies, nuclear reactor turns out to be an atomic
delayed-action
bomb which may blow up by virtue of casual reasons, as it has
taken
place,
apparently, in Chernobyl. The use of cold nuclear reactions for
production
of energy will provide mankind with cheap, practically
inexhaustible, and
non-polluting energy sources."

Selected excerpts:

"1. Introduction

'Tell me what the electron is, and I shall
explain to you everything else.'
W. Thomson

Nuclear reactions at low energies, occurring in physical and
biological systems, and, in
particular, the cold fusion (CF) of nuclei, attract ever
increasing
attention (see review articles [1,2]).
This is explained by the fact that research on CF (in what
follows,
by cold fusion we shall
understand any nuclear reactions at low energies) opens up the
way
to the solution of the problem
which was set more than 50 years ago in the field of controlled
thermonuclear reactions (CTR) and
which has not been solved - to provide mankind with cheap fuel.
An
important point is that CF
allows to create not only cheap, but also non-polluting energy
sources, as nuclear reactions at low
energies are not accompanied by radiations dangerous to health (
É_i
-radiations, streams of fast
neutrons and other particles). Note that the energetic problem
facing mankind is presently of special
interest in connection with the fact that, according to expert
evaluations, the oil-and-gas resources in
the world will suffice only for some decades. For this reason
the
study of CF is among the most
important problems of physics.

It is necessary to note that, relying on the standard theory of
nuclear reactions describing
nuclear processes in vacuum, experts in the field of nuclear
physics, engaged in CTR, reject the
very possibility of existence of nuclear fusion at low energies.

Two

basic objections are raised
against CF:

1. at low energies the penetrability of Coulomb barrier around
nuclei is so small that the
probability of nuclear fusion is practically equal to zero;

2. distinction between the atomic and nuclear energy scales is

so

great that the energy, which
might be evolved as a result of nuclear fusion, could not be
transferred directly to atomic
lattice; therefore the energy above should be emitted in the

form of

streams of \dot{E}_i -quanta,
fast neutrons and other particles. However, such streams of
sufficient intensity have not
been registered.

The answer to the first objection against existence of CF is

that at

the heart of CF are nuclear
processes occurring in environment, and the basic role is played

here, apparently, by collective
effects caused by interaction of nuclei with particles of
environment in which the nuclear reaction
takes place. The laws governing the behaviour of interacting

nuclei

in vacuum are inapplicable to
the description of CF of nuclei [3]. Nuclear reactions occurring

at

low energies submit to
completely different laws which can be established only provided

that collective effects mentioned
above are taken into account. For this reason the standard

theory of

nuclear reactions in vacuum can
by no means refute the existence of CF.

As to the impossibility of transferring the energy between

levels of

various scales, we can
give an example of the phenomenon of sonoluminescence

(luminescence

of a liquid when a sound
wave causing cavitation passes through it) [4], in which the

energy

transfer from an acoustic wave
to electromagnetic field occurs with appreciable probability in
spite of the fact that the distinction
between energies of acoustic phonons and quanta of light reaches

11

orders.

As early as 10 years ago J. Schwinger, the Nobel winner and the known expert in the field of the theory of elementary particles and quantum electrodynamics, asserted that it is impossible to deny the reality of CF phenomenon [3,4]. Since then the CF phenomenon for nuclei was repeated hundreds times in laboratories all over the world, tens of patents on the ways of energy generation on the basis of CF were registered and enormous number of experimental works were published, which not only confirm the existence of effect, but also contain its detailed analysis.

The most convincing evidence for the existence of nuclear reactions at low energies seems to give the mass-spectrometric research of reaction products [5] as well as research on biological systems [6]. Detailed study of electric explosion of foil made of especially pure materials in water, described in [5], suggests that at electric discharges transformation of chemical elements occurs. Study of optical spectrum of plasma arising at discharge and of the mass-spectrometric analysis of sediments, which remained after the discharge, shows that there appears in plasma a significant number of chemical elements which were not present in the initial material of explosive foil and electrodes and also that the isotope structure of the foil material changes appreciably. The change of experimental conditions, for example, of energy contribution in foil, its mass and dimensions results only in redistribution of intensity of plasma spectral lines, i.e. in the change of statistical weight of chemical elements in plasma, but the composition of chemical elements remains unchanged and it essentially depends on the material of foil. As is seen from the results received, nuclear reactions taking place at electric discharge are not accompanied by the occurrence of a stream of neutrons and β -radiation and proceed at low energies of atomic nuclei.

The research mentioned above as well as many others, carried out by different researchers in different laboratories, allow to draw a conclusion that

existence

of nuclear reactions at low energies is reliably established.

The development of research on CF is hampered by the absence of theory of the phenomenon. As is noted by Schwinger [3,4], the situation in CF closely parallels that in high-temperature superconductivity: reality of the last, as a result of careful experimental research, is completely established, though theory of the phenomenon is

absent

till now.

In [5], to account for the transformation of chemical elements, the hypothesis is put forward that at the electric explosion of foil in the plasma channel are

formed magnetic monopoles which may overcome the Coulomb barrier even at insignificant kinetic energy due to the great magnitude of their magnetic charge. The monopole, appearing not far from a

nucleus, causes its polarization: those nucleons of the nucleus, which are situated more close to the

monopole, experience stronger influence of the last, than the nucleons situated on the opposite

side of the nucleus. As a result, a deformation of the nucleus arises (the nucleus is lengthened), which

may result in nuclear fission. Obvious drawback of this mechanism of nuclear reactions is that magnetic monopoles have yet to be found out in nature.

Numerous attempts to construct a consistent theory of CF (see reviews [1,2]) have not been crowned with success. As it was noted above, for the CF to be described, the account of the collective effects may be important caused by interaction of nuclei

with environment, in which nuclear reaction takes place. But does it suffice to take into account these effects in order that the theory of the phenomenon be constructed? The analysis of the experiments on transformation of chemical elements at low energies and on the CF of nuclei suggests

that the phenomenon discussed does not fall within the domains of exotic ones: it seems to occur

in nature constantly, at every step, in both physical and biological systems. Therefore, it is

natural to expect that nuclear reactions at low energies should have a simple physical explanation.

However such explanation, which is not beyond the scope of existing representations, is yet to be found. Doesn't it mean that we are facing here the situation similar to that which has arisen in physics at the end of the 19th century and which has been figuratively described in the words: on the light sky of physics there are only two small dark clouds – the radiation of absolutely black body and the Michelson experiments? Remind that in order for these clouds to be removed, it has taken the revision of physical notions about electromagnetic field as well as about space and time.

As is noted in [8], there is a simple physical mechanism of nuclear transformations at low energies whose existence follows from the quantum theory of electron as an open self-organizing system [9]. If two or the greater number of light nuclei appear inside free electron, more precisely, inside the area of basic localization of the particle, because of interaction of nuclei with electrically charged matter of electronic cloud, a force of attraction appears between the nuclei which may result in fusion of nucleus. This means that cold nuclear reaction represents an intra-electronic process whose character is defined by physical properties of the own field produced by electrically charged matter of electron. The purpose of this paper is more detailed consideration of the mechanism above stemming from the spatial extension of electron.

In section 2 physical ideas are formulated and basic results are schematically presented of quantum theory of electron as an open self-organizing system.

The theory outlined is necessary to elucidate the origin of the mechanism resulting in the occurrence of nuclear reactions of fusion and fission at low energies. The essence of the approach developed consists in that the own field

created by electron is treated as a congenital, integral physical property of electron, intrinsically inherent in the particle by the very nature of things and for this reason the own field and self-action are included in the definition of the particle at the initial stage of formulating the theory. As is seen from the results received, electron represents a quantum (elementary excitation) of the field of electrically charged matter.

It is a soliton, whose physical and geometrical properties are described by the non-linear and non-local dynamical equation similar to the known Dirac equation.

In section 3 the application of quantum model of self-organizing

electron to nuclear reactions at low energies is considered. It is noted that because of the presence of simple physical mechanism of nuclear reactions at low energies, which is of a universal character, nuclear reactors represent, in effect, nuclear delayed-action bombs which from time to time may blow up by virtue of the casual reasons. Hence, though nuclear stations may provide mankind with energy, however atomic engineering is a very dangerous way of energy production. The only acceptable way of solving the energetic problem consists in the use of nuclear reactions at low energies.

2. Quantum model of electron as an open self-organizing system
The basis for the standard formulation of quantum electrodynamics (QED) is the hypothesis that electron is a structureless point particle which does not experience self-action. This assumption results in serious difficulties – the divergences of mass and charge of electron and the impossibility to explain stability of the particle (see, for example, [10-12]).

The difficulties mentioned above are very serious. According to Dirac, the difficulties of QED "in view of their fundamental character can be eliminated only by radical change of the

foundations of the theory, probably, radical to the same extent as transition from the Bohr orbits theory to modern quantum mechanics" ([13], p. 403). "Correct conclusion", Dirac emphasizes, "is that the basic equations are incorrect. They should be changed in such a way that divergences do not appear at all".

The main reason of occurrence of difficulties is the assumption that electron is a point-like particle. Therefore, abandonment of this hypothesis is inevitable.

As an analysis of the problem shows, the key to constructing a consistent quantum theory of electromagnetism lies in taking account of the Coulomb self-action of electron, i.e. the back action of the own field created by charged particle in environmental space upon the same particle.

In the special case that the particle is at rest in an inertial reference frame, own field of the particle turns into static Coulomb field. One of the boldest ideas concerning the problem of electron was

put forward by E.Schrödinger who suggested the historically first physical interpretation of quantum mechanics. According to Schrödinger's hypothesis, the quantity $(\int \rho_e dV)^2$ and $(\int \rho_e \vec{E} dV)$ are charge and wave

(ρ_e and $\rho_e \vec{E}$ are charge and wave function of electron, respectively) is the density of spatial distribution of electron's charge and, consequently, the linear sizes of electron are the same as those

of atom [14,15]. However, they did not succeed in substantiating the interpretation and, for this reason, it was rejected by the majority of physicists [16].

An important step to correct understanding of the physical nature of electron was made by A. Barut and his collaborators [16-18] who formulated and developed quantum theory of electromagnetic processes on the basis of self-energy picture (the Self-Field QED). Using expression for the total own energy of electron, they managed to

calculate the Lamb shift and other radiative corrections and to show that radiative phenomena may be described in terms of the action function, without using the second quantization method. As is pointed out by Barut [17], "the correct quantum equation of motion for radiating electron is not the Dirac or the Schrödinger equation for bare electron, but an equation containing an additional non-linear self-energy term". New lines of approach to the problem of electron are offered in [9, 19-24]. The formulation of electrodynamics is considered which represents a synthesis of standard quantum electrodynamics and ideas of the theory of self-organization [25]. The physical mechanism of self-organization of electron consists in self-action. Taking into account the self-action means that electron is treated as a feedback system.

Let us outline schematically the results of the formulation of quantum electrodynamics in which electron is an open self-organizing system.

How can the self-action of electron be described? It is reasonable to suppose that the electric charge density of electron should be described by a continuous function of coordinates which assumes everywhere finite values and owing to this the own energy of the particle should be finite. One of the hints as to how to describe the self-action of electron and, hence, to remove divergence of self-energy can be obtained from Maxwell's equations for electromagnetic field. According to them, the potential electric field $\parallel E$ created by an electrically charged particle and the total energy W of this field can be written by ...

It follows from the last equalities that the Coulomb field $\parallel E$ is not an independent degree of freedom of electromagnetic field: it is created by charged particle and cannot exist in its absence.

Hence, the Coulomb field should be included in the definition of the particle. This idea can be realized on the basis of the action principle by including the self-action of electron in the Lagrangian function already in the zero-order approximation.

...

An analysis shows, however, that equation (6) has no solutions satisfying necessary physical requirements. From the physical point of view, this is due to the fact that the Coulomb forces of repulsion acting inside electron tend to tear the particle to pieces. Formally, this is explained by the fact that potential energy U (7) represents a potential hump rather than the potential well. For this reason equation (6) cannot have solutions describing stable states of electron. Thus, the negative result is received: we have tried to take into account self-action of electron in a natural way by supplementing the Lagrangian function with the self-energy term, but we came to an equation that has no reasonable physical solutions at all. This result seems to mean that the standard theoretical scheme reaches here the limits of its applicability and so, remaining in its framework, it is impossible to solve the problem of electron and elucidate the physical nature of electromagnetic interaction.

Essentially new point which is introduced in [9] into quantum mechanics consists in the replacement of the model of isolated system described by harmonic oscillator with the model of open system. Let us advance the arguments indicating the inevitability of using the model of open system as a basis of the description of interaction between microparticles [26]. Note, first of all, that quantum particle theory based on the use of the models of isolated system is, strictly speaking, physically meaningless. Really, any observation conducted on a system represents a process of interaction of the system with the means of

observation. But in case of
microparticles (quantum particles) this interaction is not weak
and
consequently it is inadmissible to
neglect it, i.e. microparticles should be necessarily considered
as
essentially non-isolated systems.
Starting point of the standard formulation of quantum mechanics
is
the physical idea that
interaction between physical fields can be reduced to collision
of
the particles corresponding to
these fields, the particles before and after collision being
considered as free ones. According to
these representations, quantum mechanics is based on the notions
of
"bare", non-interacting
particles, with the interaction between them being considered as
an
additional factor which can only
insignificantly alter the physical properties of non-interacting
particles. However, such an approach
to interaction between physical fields is obviously of an
idealized
character because particles
constantly interact "with vacuum as with some kind of physical
medium in which the particles
move" [27]. Interaction of particles with vacuum fluctuations is
not
small and it cannot be removed.
It is well also to bear in mind that the necessary intermediary
at
studying micro-objects are
the means of observations (the devices) with the classical field
corresponding to them which should
be taken into account in consistent quantum theory [28].
Inclusion
in theoretical scheme of
arbitrarily weak classical external field results in occurrence
of
non-zero width ΔE of energy levels
of "dressed" particles. The basic impossibility to isolate a
real
particle from vacuum fluctuations of
the field and from the classical sources connected to the means
of
observation is indicative, thus, of
necessity to take into account the non-zero width of energy
levels
of real particles [26].
The use of the harmonic oscillator model, when describing the
interaction of
electromagnetic radiation with substance, seems to be the main

source of serious difficulties of the standard formulation of quantum theory, as such an approach means apparent neglect of those physical processes which, proceeding constantly, are responsible for inseparable coupling of real physical system to surrounding medium. Introducing artificial notion about switching on and switching out of interaction of oscillator with radiation field, we are able to calculate within the framework of existing theory the width of energy levels of oscillator, but we cannot assert with certainty that such an approach results in correct description of interaction.

From the reasoning given above it is seen that it is the models with energy levels of non-zero width that should form the basis for the description of interaction of radiation with substance. It is necessary to formulate such a quantum theory which would take into account the energy levels of non-zero width \dot{E}° . The case in point is that one should introduce an infinitesimal damping \dot{E}° into the initial set of equations describing interaction of charged particles with electromagnetic field. Such an approach means the violation in infinitesimal of homogeneity of physical system relative to translations in time. Necessity of violating the homogeneity of time follows from that fact that in the usual approach (with $0 = \dot{E}^{\circ}$) the states of the system of interacting fields have degeneracy of infinitely large multiplicity in relation to time translations. According to the fundamental Bogoliubov's concept of quasi-averages [29], when describing the

behaviour of degenerate systems, one should include into Hamiltonian an infinitesimal term removing degeneracy. In the theory presented here degeneracy of states of quantized fields relative

translations in time is removed by introducing the infinitesimal damping \dot{E}° into Lagrangian. Thereby the degeneracy under study is removed already in the initial, zero-order approximation, which

is of fundamental importance for the approach based on perturbation theory.

Formulation of the physical idea that quantum friction arises at the very elementary level - at the level of one particle is given in monograph [26].

Impossibility to isolate real particle from the surrounding world is that property which should be taken into account already in the one-particle theory (for each kind of particles), even before switching on the interaction with other particles.

Model of the particle as an open system ($0 \leq \dot{E}$) is attractive owing to the fact that from the very beginning the degeneracy of states relative to time translations is absent in it, the degeneracy, which is removed in standard approach by taking into account the interaction of particle with vacuum field fluctuations and classical fields. The basis for the developed formulation is the fundamental concept of quasi-averages supplemented with the requirement that the equations of motion of the particle with $0 \leq \dot{E}$ follow from the action principle. It should be emphasized that the non-zero damping \dot{E} is introduced into electrodynamics with the aim to establish the structure of the Lagrangian function which takes into account the property of openness of physical system. After establishing the structure, the limiting transition $0 \rightarrow \dot{E}$ is fulfilled.

In our opinion, the development of quantum theory will be inevitably connected with the use of models of open system, as such models reflect more completely the physical essence of interrelations in the real world. It is necessary, thus, to define more exactly the concept of openness of physical system, which, on the one hand, would describe real system accurately enough and, on the other, would be simple enough to describe the particular physical processes.

As open system has the richer physical contents in comparison with isolated system, some essentially new mathematical ideas are needed for its description.

First of all, it is necessary to increase the number of independent dynamical variables

describing

the particle as open system. In papers [9,19-24], as a basis for the description of self-acting electron, the simplest model of open system is used which can be described by the

Morse-Feshbach-Bateman

Lagrangian function [30,31] and which was successfully used for the description of dispersive media (the review of articles, in which applications of the model of open system to electrodynamics of dispersive media are considered, is given in monograph [26]). In this model the number of dynamical variables is doubled as compared with the isolated system, namely, to each dynamical variable of "bare" particle, \dot{E}_μ , there correspond two dynamical variables, which

are

denoted by \dot{E}_μ and $\sim\dot{E}_\mu$

...

Note that electromagnetic field, as well as electron field, should

be considered on the basis of the model of open system. In the simplest variant of the

theory,

each dynamical variable of electromagnetic field should be split into two independent components, one of which describes an electromagnetic wave, and the other – the environment, in which

the

wave is propagated and with which it interacts. Such an approach is stated in [9]. For simplicity, in the above are given the formulas relating to the case that electromagnetic field is described in the usual way, without doubling the dynamical variables.

Equation (16) describes one self-acting particle interacting with

vortex electromagnetic field. Generalization of this equation to the set of arbitrary number n of self-acting electrically charged particles interacting with each other is given in [9]. Equation (16) coincides in its appearance with the usual Dirac equation for charged particle in an external field described by 4-potential A . However, in reality, it differs essentially from Dirac's equation. The distinction consists in that equation (16)

is

non-linear and non-local, with the non-locality being of both spatial and time character.

Potential

($\parallel A$) and vortex ($\dot{A} \perp A$) components of the 4-potential, entering equation (16), differ

from

each other by their physical

nature: the former describes the Coulomb field and is expressed quadratically in terms of the wave function components of electron, and the latter describes transverse electromagnetic waves and is expressed in terms of vortex electromagnetic field. As a detailed analysis shows, solutions to the basic dynamical equation describe the clots of self-acting electrically charged matter, localized in space, i.e. the particle is a soliton.

The internal energy spectrum of electron is discrete with an indefinitely large number of levels, and to each value of internal energy $k E$ (k is the set of quantum numbers) there correspond certain linear dimensions and geometrical form of the region of localization of electron's charge. Dimensions and the number of extrema of wave function increase with increasing the value of energy $k E$. The distribution of electric charge of atomic electron in the ground state consists of the range of basic localization with the linear dimensions of the order of Bohr radius 10^3 ... and of the tail stretching up to infinity. It is essential that because of non-linearity of the dynamical equation of electron, wave function does not obey the superposition principle. By virtue of this, electron acquires the properties of absolutely rigid body: the perturbation acting on electron at an instant of time t in the range of basic localization becomes known at the next instant $0 + t$ at any distance from the particle.

..

According to [9,19], the atom represents a system of nuclear and electronic solitons interacting with each other, the internal energy spectrum of the hydrogen atom, due to electromagnetic interaction, being of a zoned character. The occurrence of zoned structure of energy spectrum of hydrogen atom is explained as follows. Free nucleus, because of existence of Coulomb self-action, has a discrete internal energy spectrum. As the interaction of nucleus with

electron is small in comparison with the energy of Coulomb self-action of the nucleus, it can be taken into account by perturbation theory. From here it follows at once that each energy level of free nucleus is split in a zone. There are indefinitely many zones (Balmer's replicas) and in each of them there are indefinitely many energy levels. The lowest zone coincides with the usual Balmer spectrum.

3. Physical mechanism of nuclear reactions at low energies
The quantum theory presented above schematically of electron as an open self-organizing system is indicative of the existence of the following mechanism of nuclear reactions at low energies [8].
If there occur in the region of basic localization of free electron, whose linear sizes in the ground state of the particle are several times as large as those for hydrogen atom (see Fig. 1), two or the greater number of nuclei, each of them attracts on itself the adjoining areas of electronic cloud, resulting in compression of the electronic cloud as a whole. As a result, there appears automatically an attraction of the nuclei, which proved to be "inside" electron, on each other (see Fig. 2).

11
Fig. 2. The schematic image of interaction of nuclei with electronic cloud: (a) 1 is the region of basic localization of electron, 2 and 3 are nuclei, 1 F and 2 F are the attractive forces between nuclei, which appear at the expense of electronic cloud compression induced by Coulomb forces; (b) e is the charge density, 1 is electronic soliton, 2 and 3 are nuclear solitons, $X(1,2,3)$ n n = are coordinates of the centers of mass of particles.

Calculation shows that the Coulomb barrier around nuclei is deformed, its height decreases and the probability of penetration through the barrier

accordingly

increases due to tunnel transition.

Under certain conditions this process may result in fusion of nuclei. Obviously, the process in question can occur only at small energies of translational

motion of

the centers of mass of electron

and nuclei: nuclei should be "inside" electron long enough for

them

to have time to come nearer to

each other as a result of electron-nuclear interaction. This mechanism of nuclear fusion is of a

universal character. In order for it to be realized, it is

necessary

to have only a stream of free

electrons intensive enough, i.e. heavy electric current, and as

long

as sufficiently great number of free nuclei.

If heavy nuclei appear "inside" free electron, owing to their interaction with the electronic

cloud there occurs polarization of nuclei. Because the own field

of

electron interacts with protons

more strongly than with neutrons, nuclei are deformed (become extended), and this process may result in the decomposition of nuclei to fragments (in nuclear fission).

As is noted in [7], the official version of the reasons for

Chernobyl accident contains serious

contradictions, a number of facts concerning the accident has no

convincing explanations, and this

circumstance forces to search for the true reasons for the

happening, since "not having understood

the mechanism of the one tragedy, we sooner or later shall

become

witnesses of the other". The

authors hypothesize that the reason of the accident was

penetration

into the nuclear reactor of

magnetic monopoles, which have caused the decay of nuclei ^{238}U ,

and

this has resulted in

production of delayed neutrons, growth of power output of the reactor and explosion. As an

argument in favour of the assumption, the fact is presented that

nuclei ^{238}U are disintegrated under

the action of "strange" radiation appearing at explosion of

foil.

In the opinion of the authors of [5,7], "strange" radiation is

created by those magnetic

monopoles which form bound states with nuclei of atoms. These

compound particles give the abnormally wide tracks similar to those of a creeping caterpillar, and also the tracks of complicated shape reminiscent of spirals and gratings. Character of tracks changes when imposing magnetic field, which, as the authors believe, is an argument in favour of the assumption above. There are also some special tracks very similar to scratches and ink spots. "Strange" radiation is of spherical form, it resembles a ball lightning, and its duration is more than ten times as great as that of the current pulse arising at electric discharge. With the course of time the luminous sphere (the ball-like plasma formation) is dividing into many small 'balls'."

Ken Shoulders' "charge clusters" (Jack comment)

"It is our opinion that "strange" radiation is caused by free electrons in excited state arising in the area of electric discharge. According to [9, 19], linear sizes of the region of basic localization of such electrons can make many tens of sizes of atom. The heavy nucleus, for example, the nucleus ^{238}U , appearing inside the electronic cloud, is inevitably deformed because of interaction of protons with adjoining layers in the distribution of electric charge of electron, and this deformation can cause nuclear fission. If two or the greater number of light nuclei appear "inside" electron, then attractive forces arise between nuclei which may result in fusion reaction. When electric discharge is strong enough, the areas of basic localization of some electrons can overlap, and if a nucleus lands in the area of overlap, because of Coulomb attraction of nucleus on the adjoining layers of electronic clouds, a bound state may be formed, of two electrons and the nucleus, characterized by the relative stability and significant spatial extension. Obviously, if the concentration of free electrons is great enough, there may be formed some relatively stable bunch of plasma consisting of great number of free electrons and nuclei, which in

of virtue of chaotic movement of nuclei and because of the absence of preferred directions should have approximately spherical form. Note that to "strange" radiation can contribute atomic electrons, belonging to additional energy zones of atom (Balmer's replicas associated with nuclear self-action, see Section 2).

As is seen from the above, to account for the reasons for Chernobyl accident, there is no need to involve magnetic monopoles. The scenario of development of events during the accident, described in [7], seems to be quite plausible if only to understand by initiators of nuclear fission not hypothetical monopoles but free electrons, whose powerful pulse might arise as a result of electric discharge in the region of turbo-generators.

The existence of simple physical mechanism of nuclear reactions at low energies, indicated in this paper, implies that nuclear reactors are, in effect, nuclear delayed-action bombs which will blow up from time to time. Explosion of nuclear reactor may take

place because of casual short circuit at an electric subcircuit, owing to which there appears an intensive stream of free electrons. This stream, having got for any reasons in nuclear reactor, may initiate explosion of the reactor. It follows from here that though nuclear stations may provide mankind with cheap energy, atomic energetics represents a very dangerous way of producing energy (as well as the energetics using controlled thermonuclear fusion). The only acceptable way of resolving the energetic problem consists in the use of nuclear reactions at low energies.

According to the results obtained, nuclear reactions at low temperatures occur "inside" electron under the action of own field of particle. Hence, to elucidate physical mechanism of CF, it is necessary to study in detail intra-electronic processes and physical properties of own fields of particles. Note that the own field, by its physical properties, essentially differs from the field of electromagnetic waves: this is the field of standing waves of

matter, it is of purely classical character and may not be reduced to the set of photons. The own field of charged particle plays in nature a special role, consisting in that it transforms environmental space into the physical environment (physical vacuum) with the properties of absolutely rigid body [32].

As it was repeatedly noted in the literature [1,2], experiments on CF are badly reproduced, and this fact gives rise to doubt the very existence of the phenomenon. Bad reproducibility of results seems to be explained by the fact that CF depends upon great number of parameters: upon electric current density, concentration of free nucleus, concentration of impurities and dislocations in samples, sizes of samples etc. In order to obtain reproducibility of results, it is necessary that all these parameters, describing the environment in which nuclear reactions occur, be the same in various experiments, but to achieve this is a difficult task.

In conclusion we shall dwell upon the problem of linear dimensions of electron, which is of special interest in connection with the mechanism of nuclear reactions indicated here. The inference that the dimensions of electron in the ground state of atom are of the order of Bohr radius, i.e. of the order of atomic dimensions, following from dimension considerations [9,19] and confirmed by quantum model of electron, seems completely unexpected. At first

sight, it is in conflict with both the theory of quarks and experimental data on scattering of electrons. According to quark models, the radius of electron corresponding to its quark structure makes up the quantity of the order of 10^{-22} m [33]. It is necessary to emphasize, however, that the above mentioned magnitude of linear dimensions of electron refers to the internal structure induced by Coulomb field. The last is longdistance and consequently the linear dimensions of internal structures produced by it (i.e. spatial inhomogeneities in the distribution of electric charge in various quantum states) should considerably exceed the dimensions of quark structures connected

with electron. There seems to exist a hierarchy of internal structures of particle produced by

linear Coulomb forces, nuclear forces, interquark interactions etc. characterized by the smaller and smaller sizes.

order As to the experiments on scattering of high energy electrons, according to which the internal structure of electron is not manifested up to distances of the order of 10^{-16} - 10^{-17} m, two no arguments, at least, can be adduced in favour of that there is no contradiction here with experiment. to Firstly, in experiments on scattering, investigators were trying to register the details of internal structure of electron within intervals much smaller than Bohr radius, which is why it is not surprising that results of experiments proved to be negative: at

real, high energies electrons behave like point particles, their internal structure has no time to be manifested. Secondly, the results of experiments were analyzed from the point of view of standard representations about electron, which refer to a point particle, but are obviously inapplicable to self-organizing self-acting electron. According to the predictions of quantum theory of electron as an open system, real electron is a charged special object - soliton, i.e. such a cloud of electrically charged substance which, when interacting with other particles, tends to keep its sizes and geometrical form.

it At present there is as yet no scattering theory of this kind of particles and for this reason is impossible to predict with certainty how can the internal structure of electron be manifested in experiments on scattering.

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