Fifth International Conference on Cold Fusion
9-13 April, 1995 - Monte Carlo, Monaco
ICCF5 ©1995

ON ONE OF ENERGY GENERATION MECHANISM IN UNITARY QUANTUM THEORY

Lev G. Sapogin
Department of Physics, Technical University (MADI),
Leningradsky prospect 64, A-319, 125829, Moscow, Russia

It is now a well established fact that in Cold Nuclear Fusion (CNF) only a small portion of heat results from nuclear reactions, the rest being of a mysterious origin. In this connection Prof. Peter Hagelstain writes in [1]: "Some say that this heat can be explained easily by elementary chemical reactions, phase changes, or battery-like storage effects. I have trouble with these explanations". For instance, nickel electrolysis in light water produces the same amount of energy as that of palladium in heavy water. Besides, we have to consider a no less mysterious phenomenon of sonoluminescence, that was discovered in Russia in 1933 by S.N.Rzhevkin. At first sight these phenomena seem to bear no correlation. But Julian Schwinger, the Nobel Laureate and profound research worker, has drawn parallels between cold fusion and sonoluminescence in his continuous technical publication on both topics. He notes in [2]: "Like Cold Fusion, sonoluminescence "should not exist", but it does. This now well established phenomenon occurs when ultrasonic sound, beamed into liquid, causes bubbles to oscillate stably - to expand and contract regularly - and also to emit regular pulses of light".

But one is positively struck by the heat generator built by Dr.Yu.S.Potapov (Kishinev, Moldavia), which produces in water cavitation bubbles, generating 12 kWt of heat on 4 kWt of electric energy.

This is achieved by the aid of a centrifugal pump that runs light water thought a tube with a number of special attachments. Similar, though less effective results, have been obtained in the USA by James Griggs [3]. The reactions taking place in the abovementioned cases can be explained neither in chemical nor in nuclear terms. Moreover, Potapov's system is now in production and used for heating homes. There is no doubt that the described phenomena can be viewed as "new physics" and it is impossible to describe them within the laws of conventional science.

Below it will be shown that Unitary Quantum Theory (UQT) allows one to explain all these seemingly unrelated effects. UQT was developed in 1970-1988 and its validity is proved by the fact that at a limited number of cases the theory results in both the Dirac's equations and the relativistic equation of Hamilton-Jacobi. Moreover, the solution of approximate UQT equation has yielded the electric charge value and that of the fine structure constant with reasonable exactness, the result being achieved for the first time in theoretical physics [6-14].

The solution allowed to formulate one more approximate equation for the oscillating charge particles model which gives promising results in dealing with the deutons interaction problem (the basic CNF problem) [4,5] .

Let us consider more closely, as it was done in [4,5], the particle's behavior in a potential well. The equation describing this process can be expressed in the following way:

$$\ddot{x} = \mathrm{GRAD}\, U(x)\, \mathrm{COS}^2(t\dot{x}^2/2 + x\dot{x} + f0) \qquad (1)$$

where U(x) is a potential and x, $\dot{x}$, t, f0 - a coordinate, velocity, time and initial phase correspondingly. This equation manifests a number of peculiarities. Having integrated it once, we arrive at

$$\dot{x}^2 = 2W(x,t) \qquad (2)$$

where W(x,t) is some time-dependent complex potential not amenable for analytical expression even for the simplest U(x). Therefore nothing can be said about the integrals of motion. Equation (1) behaves very peculiarly in translation - invariance conditions. It doesn't exist in common case but manifests itself at translations divisible by $\mathcal{R}_c$. That means that 2 classes of solutions are available: for the first class the laws of energy and momentum conservation are valid, while for the second class they are not.

Numerical computation for the parabolic well yields solutions of 4 types that result from different initial conditions. Similar results can also be obtained for other potentials [4].

1. The stable standard periodic solutions are obtained only for definite discrete energy E values equal to $(n+1/2)\hbar w$ at n=0,1,2... and at definite values of x, $\dot{x}$, f0. Trite solutions of the same kind are available in conventional quantum mechanics and will not be analyzed in this paper.

At other initial conditions 3 more types of solutions arise:

2. The particle performs complex oscillations of a diminishing amplitude. Sometimes at certain x, $\dot{x}$, f0 values the process starts at an increasing amplitude with its consequent decrease. At this point the particle charge and mass approach zero and after some rather long period of time the former ceases to exist altogether. This is not surprising because in UQT the particle is defined as a periodically emerging and disappearing wave packet. Its complete disappearance means that the packet's harmonic constituents have scattered so far from each other that the packet itself ceased to exist, its energy given away to the vacuum, smeared out throughout the entire space, manifesting itself only in the form of vacuum fluctuations. Let us call this solution "a crematorium".

3. The particle performs complex oscillation with an increasing amplitude, yet sometimes the process can develop with an initial short-time decrease in the amplitude. In doing so the particle's energy can increase indefinitely, if the potential well's parameters do not change. Physically this means that the particle takes energy from vacuum fluctuations but the mechanism of this process, of how it does so can be deduced only from equation (1). Let us call this solution "a maternity home".

4. There is also a diffusion solution, in which the particles tunnel into the potential gap wall. This solution is similar to that of the particle's behavior at the potential step, whence the particle in the course of considerable period of time can penetrate deep into the step. Periodic and irregular oscillations determine the energy discrete and continuous regions, respectively.

From a purely esthetic point of view it is desirable that the quantity of energy (matter) disappearing in the "crematoria" should be equal to that emerging from the "maternity homes". But I am not yet in a position either to prove or disprove it.

Solutions 2 and 3 are incompatible with conventional quantum mechanics, whence solution 4 corresponds to exponentially decaying (damping out) wave function tail at large x values.

If the system contains a number of identical wells, all the decisions of type one will be identical for them and that's the reason why the discrete energy levels are easily traced out in the experiment. But there will be no discrete levels for solutions of type 2 and 3 because each individual decision will possess its own peculiarities. The availability of these solutions can be perceived only through integral effect - either the energy release or drastic charge, or mass variation in the system, being in itself a very specific phenomenon.

Let's take a more close look at intriguing solutions 2 and 3.

I was aware of them as far as 2 years ago, which can be seen in [5, p.98]. But I was afraid to discuss the matter in my publications in the absence of reliable experimental data. Even now I am in mortal fear lest my reasoning turns out to be erroneous. But the situation has since changed and one can say now with certainty, that within UQT in quantum processes the energy and momentum conservation laws have grown from local to a global one, i.e. in individual processes the energy and momentum are not conserved, but may be taken from or given away to the vacuum. Nevertheless there exist some range of phases when the energy and momentum are preserved locally. Being summed up throughout all phases for a large number of particles the resulting energy and momentum turns out to be conserved as is shown by calculations in [5, page 93].

The experiments show, that in individual quantum processes at high energies the local energy and momentum conservation laws and conservation laws for the lepton and barion numbers are well observed. But the same is not true at small energies at least on account of ambiguity correlation [7,14]. Nevertheless the idea of global (not only local) energy conservation law is invisibly present in all quantum mechanics, it is by no means a new one. From physical viewpoint it simply means that in steady-state solutions with fixed discrete energies, the velocity of a particle reflected at the wall is equal to that of the impinging one. If the particle speed decreases upon each reflection this corresponds to the "crematorium" solution, in case it increases we face the "maternity home" alternative.

The "crematorium" solution should not be confused with the familiar phenomenon of particles' decay - it is an absolutely new and very slow process taking place at small energies. It possesses no analogs in conventional quantum physics.

The "maternity home" solution (3) has been proved by reliable experimental data for any small cavity in a metal or ceramics-made sample, or likewise a water bubble with enclosed free particles and can be viewed as a well. This can explain both sonoluminescence and the emission of heat in nickel, palladium and ceramics. The theory allows for the samples to crack because of the ressure exerted on their walls due to energy growth, the energy generation being immense in the installations of Dr.Y.S.Potapov and J.Griggs. It would be extremely helpful to create an electrically isolated system emitting great amounts of heat in order to measure its charge, which is expected to vary in the course of energy generation. This would serve as an additional proof of the picture of the phenomena described above.

Thus the excessive energy is taken from the vacuum, but this does not occur for nothing because in the neighboring wells some part of the matter would disappear. In other words, one is under the impression that a new mechanism for the direct conversion of matter into energy has been discovered. This energetic phenomenon is entirely pollution-free and thousand times more effective then that of nuclear reactions. It is for the future to prove it.

Now let's take a bit of philosophy. The Local Energy Conservation Law (LECL) in individual processes follows directly from Newton's equations under the condition of uniformity of time. It would be naive to think that his local definition will remain unchanged. The trend in modern physics now is to treat the LECL, especially in theory, as a conclusion of secondary importance from the motion equation (integrals of motion). Some physics confine LECL within the limits of the first law of thermodynamics others as D.Blokhintsev maintain that "it is highly probable that the development of new theory will make LECL change its form" [15].

F.Engels wrote in "Nature Dialectics" "...no physicist regards essentially the LECL as an eternal (ever-lasting) absolute law of Nature, the law of spontaneous transformation of matter motion forms and the quantitative stability of this motion throughout all its transformations". But many research workers are of a different opinion as M.P.Bronshtein [16] who wrote; "The ECL is one of the fundamental laws of Newton mechanics. Yet, Newton himself had never ascribed to his law the uniform character, which it possesses in reality. The reasons for such erroneous treatment of the ECL on Newton's part are extremely interesting...".

The idea to treat the ECL in quantum mechanics equally with the second law of thermodynamics as a static law, being true only in average cases and unsuitable to individual acts, goes back to [15] E.Schrodinger , and later to N.Bohr, H.Kramers, I.Slater and G.Gamov. L.Landau had called it "a beautiful Bohr's idea" [15]. Yet, later it was rejected by the authors themselves. It should be noted that this idea did not follow from the quantum theory equations. But the brilliant idea still remains one, even being reject by the person to whom it had occurred. In fact, it may simply turn out to be premature. Eventually,all the cosmologist's dream of having a process explaining why throughout the entire Universe there are some places where energy emerges, being extinguished in the others. It is interesting that solution 3

gives one an opportunity to set a very small initial fluctuation, which then will accumulate energy and turn into a particle.

One has to accept the truth regardless of it's source. Therefore I will conclude with the words of F.Engels. "But when the solar system completes its life-path and shares the fate of everything finite, when it falls victim to death. What then? Thus we come to the conclusion that the heat emitted into world space should have an opportunity by some miraculous way, which it will be the task of future science to define, to turn into some other form of motion, in which it can accumulate again and start functioning. In this case the main difficulty becomes obsolete, the one obstructing the reverse change of dead suns into a red hot nebula".

One can expect that having read this paper some high-brow theoreticians will assume attitude of persons being witness to some childish tactlessness. But in the course of physics' development it was experimentation that had always been the main judge.

I'd like to express my gratitude to N.V.Famina, the attractive translator of the article. I am equally thankful to Drs. F. Jager, O.Finodeyev, V.A.Boichenko, O.I.Kasakov, I.V.Kulikov, F.Mair and Yu.G. Rudoy for taking part in the discussion and practical help in my work.

References

1. Hagelstain. "A plethoria of 'miracles'".Cold Fusion vol.1, No.3, p.22, 1994
2. Schwinger. "Cold Fusion: Does it have a future?". Cold Fusion. vol.1, No.1, p.14, 1994
3 Rothwell, Mallove."The hydrosonic pump: An excess energy device?" Cold Fusion. vol.1, No.2, p.26, 1994.
4. Sapogin. "Deuteron interaction in unitary quantum theory", "On the mechanisms of cold nuclear fusion". Proceedings: Fourth International Conference on cold fusion.Vol.4: Theory and special topics papers. TR-104188-V4. July 1994 (Hawaii)
5. Sapogin. "Deuterium interaction in unitary quantum theory", "On the mechanism of cold nuclear fusion". Cold Fusion Source Book. International Symposium on Cold Fusion and Advanced energy sources. Belarusian State University. Minsk, Belarus, May 24-26, 1994
6. Sapogin. "Unitary Field and Quantum Mechanics." Investigation of systems. (in Russian, Vladivostok, Academy of Science), No. 2, p. 54, (1973).
7. Sapogin. "On Unitary Quantum Mechanics." Nuovo Cimento. vol. 53A, No. 2, p. 251 (1979)
8. Sapogin."An Unitary Quantum Field Theory", Annales de la Fondation Louis de Broglie. vol. 5, No.4, 285 (1980)
9. Sapogin. "A Statistical Theory of Measurements in Unitary

Quantum Mechanics." Nuovo Cimento. vol. 70B, No.1, p.80 (1982).
10. Sapogin. "A Statistical Theory of the Detector in Unitary Quantum Mechanics." Nuovo Cimento. vol. 71B, No.3, p. 246 (1982).
11. Boichenko, Sapogin."On the Equation of the Unitary Quantum Theory." Annales de la Fondation Louis de Broglie. vol. 9, No. 3, p.221 (1984).
12. Sapogin, Boichenko. "On the Solution of One Nonlinear Equation."Nuovo Cimento. vol. 102B, No.4, p.433 (1988).
13. Sapogin, Boichenko. "On the Charge and Mass of Particles in Unitary Quantum Theory." Nuovo Cimento.vol.104A,No.10, p.1483 (1991).
14. Sapogin. "Clear-cut picture of micro worlds".Technic for the young (in Russian) No.1, p.41 (1983).
15. Blokhintsev. Collection of scientific methodological works in physics.(in russian). State University of Moscow,1993.
16. Bronshtein. The matter structure.(in russian). Moscow,1935.