All,
We developed a new mechanism of cold fusion reactions (see attached file).
If somebody can participate in this direction in the project ARPA-E,
comminicate please with us.
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New Mechanism of Cold Fusion Reactions

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A new mechanism of cold nuclear fusion reactions is proposed by Yu.L. Ratis [1, 2] which completely in conforms with the known fundamental laws of physics. It is shown, that neutral nuclear active composite particles, due to which the cold fusion reaction proceeds are bound states of two neutrons and single neutrinos. These particles are called "dineutroneum". They are exotic neutron atoms participating in nuclear reactions.

Dineutronium atoms are metastable. The lifetime of dineutroneum D_ν in the low energy region of strong interactions are equal to 10^{-3} s and is essentially greater than the lifetime of n. The decay channels $D_\nu \rightarrow n + anything$ are closed down in these cases.

The sizes of dineutronium atom are commensurable with the sizes of deuteron, and its mass is equal to $M_{D_\nu} = 1876.0979650 \, MeV$.

The dineutroneum generation reaction $D\left(e,e^{'}\right)D_\nu$ in gaseous deuterium has the threshold $E_{tr}^{gas} = 14.86 \, eV$ and the cross section is approximately equal to 10 mbarn, the corresponding threshold in condensed matter $e^- + d \rightarrow D_\nu + phonon$ equals to $E_{tr}^{cm} = 1.27 \, eV$ and the cross section 1 mbarn.

The proposed model describes:
a) the abundance of the tritium in Nature;
b) the ration T / n in the low energy nuclear reactions ($T / n \square 10^9$);
c) the production of exceed heat and helium in the experiments of Arata Y. and ZhangY.-C.;
d) the output of I.S. Filimonenko's reactor.

Some corrections are introduced into Mendeleev's Table. It is shown that in the Periodic Table the dineutroneum is located as a neutron in the zero row of the zero period. Thus dineutroneum is a heavy isotope of a neutron.

The great lifetime, small sizes, electrical neutrality and great cross section in reaction $e^- + D \rightarrow D_\nu + X$ allow dineutroneum atoms to participate in nuclear reactions with the surrounding nuclei. Therefore, the synthesis of dineutronium atoms can be justified [1,2] from the economic and energy point of views.

References
1. Ratis Yu.L., Metastable nuclear-active substance – dineutronium. Application for invention rights N2008147689 on 04.12.2008. Federal department intellectual rights of ownership, patents and trade mark.
2. Ratis Yu.L., Controlled "thermonuclear" or cold fusion? The drama of the ideas. Samara. Issue SSC RAS, 2009. 93p.