On possibility of creating a muon-catalytic reactor based on periodic injection of ball lightnings in a chamber with D-T mixture

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On possibility of creating a muon-catalytic reactor based on periodic injection of ball lightnings in a chamber with D-T mixture

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The concept of muonic catalytic fusion is one of most promising approaches to nuclear fusion [1]. New scheme to trigger fusion in a compact magnetic fusion device by combining muon catalysis and alpha heating effects was proposed in [2]. The authors plan to use picosecond laser to generate muons. The main problem of muon-catalyzed fusion lies in the fact that existing sources, such as linear accelerators and lasers, require considerable energy expenses for the production of muons. This problem can be successfully solved if there is a method that allows to obtain the muons with small expenditure of energy. F.Bacon noted many years ago that all the best exists in Nature and necessary only give for it the practical application. In the natural environment there are other ways to obtain muons. Generation of muons and muon neutrinos occurs as a result of cascade processes in extensive air showers, which were discovered by P.V.Auger [3].

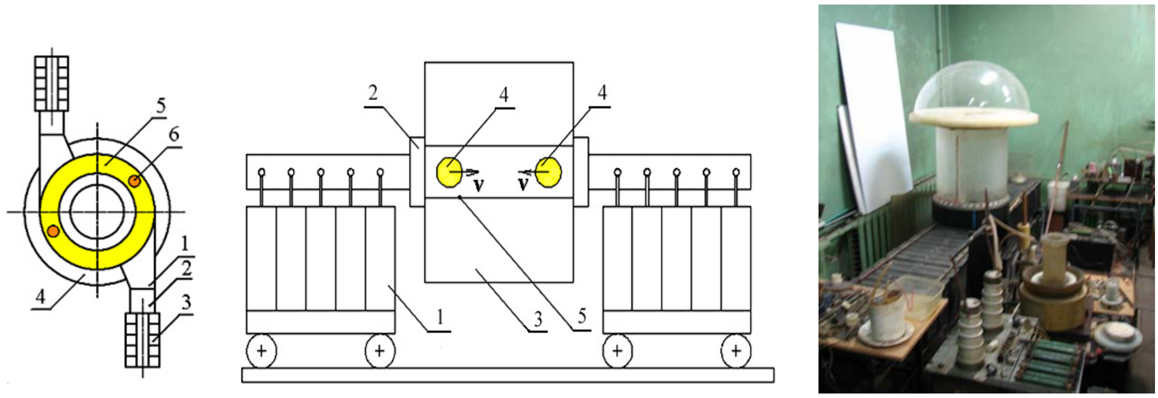
As follows from theory, the reaction of muon catalyzed fusion can occur at a very low temperature [1]. The stars are sources of the fast protons. Probably that cascade process and generation of muons occurs as the result of interaction between the protons and particles of the solar corona. There are sufficient grounds to believe that due to the muon catalysis, the nuclear fusion reaction in the solar corona occurs at a temperature of $T = 1.15 \cdot 10^7 K$. The first experimental results on muon-catalized fusion [4] had initiated the appearance of a number experimental and theoretical studies in this direction.

A cheap source of muons is ball lightning, which interacts with a target or a dense low-temperature deuterium-tritium mixture. The generation of muons allows using them to carry out the nuclear fusion reaction as a catalyst. It is possible that the ball lightning can provide the solution of the problem of obtaining fusion energy with minimal cost. Observers in natural environment found that during the entrance of ball lightning into the container with water the full evaporation of water occurs. The estimates obtained for the thermal energy density of ball lightning with a temperature of 1.5 eV are overestimated. Anomalous heat generation during the entrance of ball lightning in water can be explained only by the nuclear fusion reaction.

Earlier by one of the authors experiments on the generation of ball lightnings in a stream of water vapour were performed [5]. The ball lightning was created in the central part of steam flow produced by a source of vapor. The vapor was supplied to the generation area of the ball lightning by means of two tangentially installed pipes inside the cylindrical chamber of polyethylene. The diameter of the steam jet exceeded the ball lightning diameter. The steam jet length in vertical direction was approximately equal to 3 m. As is known, there is deuterium in the water and density of it in a water vapor is sufficiently high. The neutron fluxes were not measured due to the lack of diagnostic tools. However, the state of health of the experimenter during the experiments with water steam sharply deteriorated after 2-3 start-ups of the experimental facility. Without water vapor 10 -15 start-ups were usually performed per day. Air has humidity due to the presence of water vapor and it contains hydrogen izotopes. In the ball lightning exist the conditions for realization of a nuclear reaction [6]. It should be noted that in the deuterium medium were observed reactions type

$dd \rightarrow n + 3He$ and $dd \rightarrow p + t$ in the high-pressure chamber at very low temperature in an experiments [7]. A correct explanation of the experiments on generation of ball lightning in a water vapor medium and at interaction of the ball lightning with water was given only after obtaining [8] and analysis the results on the anomalous passage of ball lightning through thick absorbers [9]. The phenomenon of anomalous passage of ball lightning through solid-state absorbing filter can be explained only by the multistage generation of elementary particles at the interaction of high-energy protons of the external shell of ball lightning with a dense medium [9]. The nature of phenomenon lies in the fact that when a ball lightning interacts with substance it becomes a source of muons and muon neutrinos. High-energy protons appear in the external shell of ball lightning due to the nuclear photoelectric effect during its generation. The existence of muons and neutrino at the interaction of ball lightning with a thick metal absorber is confirmed by the presence of a black ball lightning passed through the absorber 6 cm thick from plumbum [9]. In the ordinary state, the energy that protons of ball lightning gained in alternating fields is equal to 20-25 MeV [4]. Using the energy converter allows protons to gain energy, which is required for generation the pions (E=140 MeV). The decay of pions, as is well known, leads to generation of muons and muon neutrino. As is known, one and the same negative muon can participate in 120-150 fusion events for during of its existence. Interest represent the cycle associated with the use of negative muons $\mu^- + (d/t) \rightarrow dt\mu \rightarrow He^4 + n + \mu^-$.

An interesting application is a periodic injection of ball lightnings into the chamber of the reactor of nuclear fusion which was preliminary filled of plasma. A schemes of two possible reactor types of nuclear fusion on base of muonic catalysis by means of ball lightning are given in Fig.1 (a,b) as a first approximation. An image of an experimental installation on base of the four-stage generator of Marx (U=220 kV, I=120 kA) is given in Fig.1 (c).



a b c

Fig. 1 (a) A scheme of toroidal reactor of nuclear fusion on base of muonic catalysis by means of ball lightning; (b) a scheme of a linear reactor of inertial nuclear fusion on the basis of two colliding ball lightnings; (c) an experimental installation on base of the four-stage generator of Marx. Designations in Fig. 1 (a): 1- branch pipe; 2- electrical spheretron (source of the ball lightnings); 3- capacitive energy storage; 4- blanket with lithium and heat-exchange apparatus; 5- toroidal chamber with plasma; 6- ball lightning. Designations in Fig. 1 (b): 1- capacitive energy storage; 2- electrical spheretron; 3- blanket with lithium and heat-exchange apparatus; 4- ball lightning; 5- chamber of reactor with plasma.

The problem of nuclear fusion can be solved on base of muonic catalysis at presence of supporting. The criterion of proposed idea correctness can be only an experiment which can be carried out with minimal cost. It should be noted that traditional methods of producing fusion reactions creates and have a number of insoluble problems [10]. The proposed method of nuclear fusion has a number of significant advantages compared to existing methods. The method is based on real data obtained by the authors in the experiments on generation of ball lightnings. Thus, the generation of muons by means of the ball lightning makes it possible to create a breakthrough technology in nuclear fusion which has no unsolvable problems. In a short time it is possible to create a compact nuclear fusion reactor which will give an energy. The approximate cost of creating a demonstration version of the reactor based on muon catalysis in one hundred million times less than the cost of the demo version of tokamak. It should be note that the experimental facility for obtaining ball lightnings at the same time is a unique compact generator of protons, neutrinos and muons at presence of target. There is also possibility of using the ball lightning for proton-boron cycle. The muon-catalyzed fusion on the base of ball lightning has no insoluble problems for it practically implementation and it has much more chances for obtaining energy in comparison with traditional methods. The suggested method of solution of the problem fusion requires an experimental validation. Ball lightning is the key to solving the problem of obtaining environmental pure energy. This key must be used.

Ball lightning can be used also in scientific and applied purposes for solution a number of problems such as obtaining of fast protons (including their using in proton therapy), muons and neutrinos. It is possible, that devices based on strong vortex fields of ball lightning will find applications for the purposes of radiography, for the radiolysis of gases and liquid radioactive waste, and for other humane purposes.

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