Muon catalyzed fusion might be the “ignition key” for lattice-assisted nuclear reactions

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Abstract

The required conditions for igniting and maintaining the lattice-assisted nuclear reactions are different. The required conditions are strict for the ignition, and looser for maintaining the reaction. The ignited reaction is stable and remains active for a very long period of time. These observations indicate that the experimental conditions in the deuterium-palladium electrochemical system meet the requirements for sustaining the reaction, and the so-called reproducibility problem arising from the uncertainty of ignition of the process. It is hypothesized that muon catalyzed fusion ignites the reaction, which then becomes self-sustained. The random nature of the cosmic ray produced muons is consistent with the observed reproducibility problem. Cosmic ray muons, collimated by electric, and/or magnetic fields, might be the right tool to reliably ignite the LANR process. The optimum energy and flux density of muons, which can activate the fusion, could be experimentally defined. Planetary and astrophysical aspects of the proposed hypothesis are briefly discussed.

Keywords: muon catalyzed fusion, cosmic rays, lattice assisted nuclear reaction, cold fusion, internal heat production of giant planets, ignition of stars,

Despite the rejection of Fleischmann and Pons experiments [1, 2] by mainstream science, in the past three decades many hundreds electrochemically induced excess heat, beyond the quantity of chemical reactions, has been reported from well-established laboratories [3]. The measured ^{4}He fission production in the experiments gives the correct magnitude for typical deuterium fusion. In many cases, the measured quantity of ^{4}He is higher than the atmospheric level, which excludes the possibility of contamination [4]. These experiments convincingly demonstrate that lattice-assisted nuclear reactions are real, even though reproducibility remains a problem.

The required conditions for successful experiments are deduced, and well known for the palladium–deuterium electrochemical system. However, satisfying all the known required conditions still does not guarantee that the reaction will be active. Interesting feature of the experiments is that the required conditions for the initiation and for the maintenance of the reaction are different.

It is well established that one of the ingredients of a successful experiment is that the loading ratio of D/Pd should be higher than 0.85% [5]. However, if the reaction is started then the required D/Pd ratio can be reduced significantly without affecting the reaction [6]. Laser excitement can start the electrochemically induced excess heat production in the palladium-deuterium system [7]. However the reaction remains active even if the laser is turned off.

These experimental results suggest that the conditions in the electrochemical palladium–deuterium system are sufficient to maintain an ongoing reaction. This conclusion is consistent with the long-term stability of the experiments. If the reaction starts then it remains active for many hours, days or even for weeks [ex. 2]. Thus the maintenance of the reaction does not seem to be a problem. Consequently, the so-called reproducibility problem most likely results from the uncertainty of the initiation of the reaction.

The only currently known and experimentally verified fusion at room temperature is the Muon catalyzed fusion. The possibility of cosmic ray induced nuclear reaction has been predicted in 1947 [8], and detected ten years later [9]. The Muon-Catalyzed Fusion Reaction occurs in a deuterium environment as:

$$\mu^- + de \rightarrow d\mu^- + e$$

and

$$d\mu^- + d \rightarrow dd\mu^- \rightarrow He^4 + \mu^-.$$

With the exception of the added muon, this nuclear reaction is identical to the one observed in the electrochemically induced deuterium palladium system.

The freed muon can catalyze further deuterium, but the cycle has limitations because the muon can remain attached to the produced alpha particle [10, 11]. Thus the muon catalyzed fusion reaction requires continuous supply of muons; therefore, this well documented cold fusion process energetically is not feasible at the level of current technology.

It is hypothesized that lattice-assisted nuclear reactions are assisted or initiated by Muon catalyzed fusion. Following the ignition the reaction becomes self-sustained. The random flux of muons in cosmic rays is consistent with the uncertain nature of the experimental outcomes.

Exposing the reactor chamber with sufficient muon flux could ignite the reaction, and eliminate the uncertainty of the LANR experiments. Following the ignition the reaction becomes self-sustained and the extra muon flux can be turned off. The muon initiated fusion process could produce energetically feasible, and reliable energy. The required energy and intensity of the muons, capable of triggering the reaction, and the length of the exposer requires further research.

The proposed hypothesis has astrophysical consequences. The observed internal heat production and emission of the giant gas planets in the solar system [12] most likely the result of muon catalyzed fusion. If this hypothesis is correct then heat production of the planets should correlate to the intensity of cosmic rays. It should be noted that the internal heat production of the giant planets is an indicator of the natural occurrence of cold fusion. Reaching critical conditions in the giant planets, muon catalyzed fusion could ignite hot fusion and form a star.

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