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Stimulated Cold Fusion by Positronium Atoms

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Abstract

The feasibility of the method introduced in this paper (stimulated cold fusion by positronium atoms) relied on the subtles of the state-of-the art that through a reciprocal approach one could keep the Plasma cold (the lower the plasma temperature the least the plasma problems engaged) and far from complexities involved. Then feeding process of the plasma to proceed fusion reactions leading to self-sustained situation is running through a prefusion reaction by means of positronium exotic atoms annihilation in plasma media.

Obviously without the needs of powerful lasers and giant magnet for heating plasmas to proceed thermonuclear fusion, two cold light atomic hydrogen ^1H fuse together whilst an amount of energy about 100 eV i.e. 10^6 K starting energy to overcome mutual electrostatic repulsion of two atoms would supply by pair annihilation process.

Keywords:

cold plasma, pair annihilation, ignition temperature, plasma confinement

1. Introduction

The needs for a vicegerent of fossil fuels, have made the controlled thermonuclear, the most outstanding challenges the man had ever been faced. The investigation grounds on these topics have gone through new historical era of physics since the first quarter of the 20th century, which plasma physics devised by Langmuir, experiments, i.e., that branch of physics which governs to almost about 99 % of the universe as a whole.

It was thereafter that the plasma physics settled down in the heart of controlled thermonuclear reactions, which the challenge included:

i) High temperature plasma, ii) Plasma confinement and ignition temperature, iii) The costs.

It is based upon these complexities that goals of breeding the cold plasma seemed reasonably capable to solve the power plants easier although as introduced by a number of researchers in brief its outlook have not been nicely efficient.

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2 Cold Plasma's, Specifications and Characteristics

Noticeably the temperature in cold plasma compared with those of hot plasmas dragged drastically down (about 0.01 eV) so that:

(a)- The plasmas, partially ionized.

(b)- Because of high enough inertia the ions constitute the positive grounds of the plasma.

(c)- The electrons would follow the ions movements to keep the plasma neutral (so the plasma approximation $n_i = n_e$ and $\nabla \cdot E \neq 0$ hold true) [1].

(d)- The polarization drifts vanishes, and the particles do not move so fast in response to the external fields.

(e)- Then in cold plasmas the plasma oscillations would be the electron oscillation around their equilibrium position with the plasma frequency [2].

(f)- The propagating waves through plasma are necessarily pure electromagnetic waves [2].

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(g)- For electrons a single osillation in the form of Langmuir oscillation within finite wave number occurs [3].

(h)- In above mentioned situation in a usual laboratory plasma for instance (Hydrogen with n=10^{10} cm^{-3}, and B= 1 kG) , the dielectric constant increased incredibly higher than that of vacuum and in turn the electrostatic fields due to particles could greatly shield the applied external fields [4].

(i)- A dielectric tensor for the cold plasma should be taken into account, so as concluded transeverse and longitudinal motions as below:

$$\varepsilon = \begin{Bmatrix} \varepsilon_{11}\ \varepsilon_{12}\ \varepsilon_{13} \\ \varepsilon_{21}\ \varepsilon_{22}\ \varepsilon_{23} \\ \varepsilon_{31}\ \varepsilon_{32}\ \varepsilon_{33} \end{Bmatrix}$$

(j)- As usual plasma with bigger dielectric constant could commonly shield alternating fields, while a plasma with small ε and λ_D shield DC fields [5].

(k)- In cold plasma based upon low mobility of charged particles, the fluid dynamics approximation (with the plasma composed of two or more interpenetrating fluids, one for each species) together with fluid equations of motion, conservation of energy (the equation of the fluid continuity) stress tensor and diamagnetic diagnostic tests with thermodynamically imposed problems in a rarefied consideration are to be taken into account.

(l)- The ignition temperature, which forwards the fusion reaction as a self-sustained plasma, responsible for the compensation of the energy losses and that of liberation in plasmas, in turn depend on three factors: i) On plasma density, ii) Composition and iii) The volume.

Obviously, in cold plasma there are no technical limiting cases applicable to neither of those triplet problem. Ignition temperature is controlable through the size of plasma vessel and the plasma density itself, the higher the density of the plasma the lower is the ignition temperature.

(m)-In cold plasma, the physical size of container exerts no limiting criteria because of the slow motion of the particles and low energy losses through the collision of those particles to the surface of container, then the plasma vessel could sized as permissibly that technical limitations applied.

(n)- Last but not least it is believed that cross section of double (D-D) reactions versus kinetic temperatuer are maximun, so if the escape of the radiation from plasma prevented the ignition temperature of the (D-T) reaction is about one tenth of that of (D-D) reaction [6].

3. Stimulated Cold Fusion by Positronium Atoms

The Moun catalyzed cold fustion as suggested theoretically by Frank and Sakharov in the 1940s which experimentally bore evidence by Alvarez and Colleague [7], as stated, were too slow to generate useful energy capable to proceed fusion reaction.

In this paper a crucial approach introduced with the compensation of failures thus far, using a relevant stimulus, applied on cold plasma.

4. Exotic Positronium Atoms

The positronium atom (thus forms only when a positive lepton replaces a single nucleon namely a proton), which treated as light isotop of hydrogen, in turn is the lightest of all known new atoms, without a nucleus, which the center of mass does not coincide with either instead lies in between them. Interest in positronium atoms chiefly comes from the fact that their characteristics are appreciably influenced by their constituent, i.e, electrons and positrons which in form a positronium only a positron captured by an electron in an electron plasma.

Positronium the lightest Hydrogen's isotopes, together with its properties that Quantum, electrodynamics, confirmed and only its ground state yet been found, with a reduced mass half of atomic hydrogen, but the latter 920 times heavier. The distance between stable pair in the form of positronium is twice the Bohr radius in hydrogen atom,with an ionization potential half that of the latter (i.e., 6.8 eV) and extremely short lifetime about 10^{-7}–10^{-10} s.

In vacuum with an urgent annihilation positronium gives off γ-quanta under general physical laws of conservation in a singlet or triplet γ emission [8].

The singlet or triplet γ-quanta in turn exerts radiation pressures about hundreds thousand of atmospheres on plasma as though powerful laser beams being applied to the plasma, could heat and confine plasma. As the γ rays applied forces on plasma, tend to deviate the dielectric constants inside higher than

Table 1 some properties of positronium

property	Type of state	
	Two singlet	Triplet
Symbol	Sp_s	tp_s
Spin state	↓↑	↑↑
Quantum number	J=0	J=1
Proper lifetime	1.25×10^{-10}s	1.4×10^{-7}s
Annihilation type	2γ	3γ
% Share	25	76

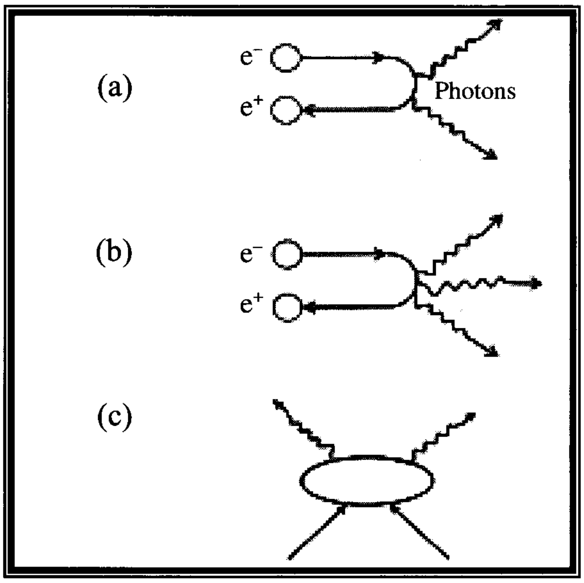

Fig. 1 a. Decay of para positronium
b. Decay of ortho positronium
c. Feynman scheme for pair annihilation

outside the beam, based upon the plasma acts like a convex lens both in singlets or triplets γ Jets as the same way that laser pondermotive force acts on plasmas [9].

In the normal mode of pair annihilation instantaneously the energy amount about 2×0.51 MeV ($2\times5\times10^9$ K) would be produced associated with the pair rest mass *in the from* γ rays. Obviously the stimulation of the plasma by means of induced γ emission into the media is more efficient if the γ rays could carry high enough energy above that of pair rest mass reasonably by electrons positrons being recirculated in a microtron accelerator before annihilation take place. This can proceed more successfully if one uses Ring storage (LEP - CERN, which currently used to create weakly interacting particles) in a rarefied scheme, to accelerate the pairs up to energies capable, to stimulate nuclear fusion plasmas, relevantly (although in rather head- on collision LEP designed to operate with the e^-, e^+ beams of up to 90 GeV with fixed e^- target and an e^+ beam of 32 GeV relativistic particles hitting on stationary target giving $E_{cm} = 2\times20$ GeV) [10].

5. Conclusion and Remarks

The problem of controlled thermonuclear fusion reaction, apart from its complicated technological problems, posed the plasma requirements such as the least temperature to fuse hydrogen atoms together, longterm confinement of plasmas, the cross section of reactions,... etc. In approach devised, although a glimpse have put on here, its main theoretical interpretation would ask detailes of the arts of new atoms together with physico – chemical features of the phenomenon.

The practical facets of investigation left aside because it needs more experimental evidence. The most outstanding privilege urgently evoked is: i) The energy released in pair's annihilation tends to increase the energy of fusible atoms and ii) The urgent occurrences of annihilation in nanosecond fraction of time would exclude the confinement problems of reaction. To clear the details of process a number of experimental evidences in the field is necessary.

Hope that this quite promising method of probing into the matter eventually could over views the power plants. The Modeling of the process is in current now.

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