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COLD PLASMA ELECTRIC COMPRESSION FUSION

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ABSTRACT. All experiments of fusion of hydrogen (except the LENR type) are done at high temperatures. The main models being the Tokamak magnetic confinement and the Inertial Confinement models. The new design proposed here is based on a novel idea not attempted before. It uses direct electric field compression of a cold deuterium plasma (which may even be near 0 K) to undergo nuclear fusion. At high temperatures, the only reaction possible is fusion to helium-3, a neutron and gamma-rays of a definite energy. A direct fusion of deuterium-deuterium to a lone helium-4 nucleus without the production of a neutron is possible provided the initial deuterium carries no kinetic energy; this means such a reaction may happen only near absolute zero temperatures. So far, this reaction at cold temperature has not been contemplated by the nuclear fusion community. This fusion design is simple and most research laboratories would have the resources and technology to experiment with this new design.

1. INTRODUCTION

[Version 1.1] Except for LENR type experiments, all current hydrogen fusion experiments are of the thermonuclear fusion type at very high temperatures. The best known being the tokamak model through magnetic confinement of a hot plasma. The first tokamak reactor was first tested in 1958. To date, it could be said that six decades of high temperature fusion experiments around the world have not given us any definite result indicating that such an approach would soon enable us to harness clean fusion energy replacing our dependence on fossil fuel. There is no attempt yet of any hydrogen fusion at cold temperatures as it is the prevalent belief that it could only occur at temperatures near that as found at the core of the sun. The design concept proposed here is novel as it does not rely on high energy collision of ions to overcome the Coulomb repulsion, but relies directly on the electric field to overcome the Coulomb repulsion. Our assumptions of the conditions for the fusion of deuterium to helium may not be correct if what we know about the physics of the atoms and the nucleus may be just scantily little. Without the need

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to accelerate ions to high kinetic energy, the temperatures could be just room temperatures. In fact, temperatures close to 0 K should be tested as weird phenomena may show themselves at extreme ends of the temperature scale. There are too many temperature intervals to cover going to the high end limit of infinity, but there are only about 293 centigrade degrees to step through from room temperatures to the cold limit of absolute zero.

2. The Temperature Of The Sun's Core

The reason why most attempts at fusion experiments follow the high temperature model is because of the accepted prevalent model of the sun; that fusion is happening in the core of the sun and such fusion happens because the the sun's core has temperatures in millions of degrees. It is assumed that only through a high kinetic energy of the core material that the Coulomb repulsion of the nuclei may be overcome when they collide thus enabling them to undergo nuclear fusion. The assumed high temperature of the sun's core is just only an assumption. No physicist has ever provided any argument that the sun's core cannot be cold. We could build a model of the sun with a cold core just as we may argue for a model with the core at millions of degrees. In the end, there is virtually no way to know if the core of the sun is hot or cold. So we cannot preclude that fusion is happening in the core of the sun at cold temperatures. On the other hand, even if fusion in the sun is actually happening at high temperature, it does not preclude that cold temperature fusion could not occur. Whether cold temperature fusion may or may not be successful is decided finally through experimentation.

3. The Deuterium-Deuterium to Helium Reaction

Before we discuss the proposed nuclear reaction that is to be carried out for this reactor design, we have to briefly go into some very controversial discovery by the author of this paper concerning the current accepted view of the source of nuclear energy[1, 2].

- There is no mass-energy equivalence based on $E = mc^2$. Firstly, $E = mc^2$ evaluates only to a pure number without association with any real unit of energy. The formula relies on a redefinition of relativistic force as:

$$force = \frac{d}{dt}(\frac{mv}{\sqrt{1 - \frac{v^2}{c^2}}}) \tag{1}$$

  But such a redefinition of force from (1) cannot be used in any way to define a real physical unit of force in any system of units. The new force cannot take on the SI unit of the newton as the newton is strictly defined based on the classical formula $force = invariant\_mass \times acceleration$. When force is fictitious, then the the application of the work_energy theorem results in an energy formula which also evaluates only to a pure number with no association with any real unit of energy. All of relativistic mechanics is founded on a fictitious scale of energy. The physical reality of relativistic mechanics cannot be compatible with the physical reality based on classical mechanics.

- There is no *'mass defect'* of atoms. The concept of mass defect is the direct consequence of a systemic error when atoms are weigh using mass spectrometers - such as the Penning trap. The Penning trap has very high precision but it is not the correct instrument to measure the mass of atoms or ionizes particles - it will give systemic error in all mass measurements. As shown in the author's papers [2, 3], there is no need to do any measurement to know the mass of any nuclide; the mass of any nuclide is simply the mass number of the nuclide in amu, a whole number. This is because the law of mass conservation is universally valid.
- There is no need to propose the strong nuclear force. The author's paper [3] shows that the Coulomb electric force is sufficient to explaine the nuclear binding energy. In fact, there is only one universal force of nature; it is the same old Coulomb electric force. The SUT (Simple Unified Theory) model treats the neutron as just another proton and an nuclear electron. So the subatomic particles of the atomic nucleus are just the proton and the the nuclear electron. The Coulomb forces within this new model can be stable just depending on the same Coulomb electrical forces of attraction over the net repulsion. Therefore, binding energy within the nucleus is Coulomb binding energy.

If two deuterium nucleus at velocity v collide and undergo fusion, it cannot produce a lone helium-4 nucleus. The need to both conserve momentum and energy requires the production of at least two particles. The reaction that has been verified is:

$$^2H^+ + {}^2H^+ -> {}^3He^{2+} + n + \gamma\_ray \tag{2}$$

The γ_ray would be of a definite energy defined by the release of Coulomb binding energy of the protons in the nucleus. The radiation results from the protons going from an originally higher energy state to a lower energy state in helium-3. The initial kinetic energy of the two deuterium nucleus must be strictly preserved by the helium-3 nucleus and the neutron. In the tokamak thermonuclear reaction, the same externally supplied extreme high energy must be carried away by the helium-3 nucleus and the neutron.

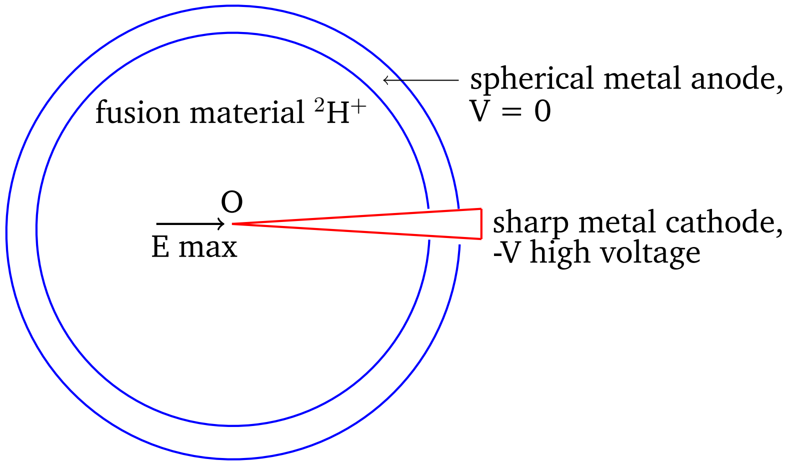

FIGURE 1. Cold Plasma Electric Field Compression Fusion. Highest electric field is at the tip of the needle; suggested temperature near absolute zero.

So far, the nuclear fusion community has never contemplated a direct deuterium-deuterium fusion reaction to a lone helium-4 nucleus without an accompanying free neutron:

$$^2H^+ + ^2H^+ -> ^4He^{2+} + \gamma\_ray \tag{3}$$

This reaction is possible only if the deuterium nucleus both carry no initial kinetic energy, .i.e with velocity v = 0. With the initial deuterium nuclei having no momentum nor kinetic energy, there is not a need for conservation of momentum nor energy; the final product being just a lone helium-4 nucleus is allowed. This means such a reaction is possible only at near absolute zero of temperatures. To date, such fusion experiments at cold temperatures have never been attempted.

4. Basic Design For A Cold Plasma Fusion Reactor

The tokamak model as well as the inertial confinement model requires high temperatures. The model proposed here prefers the simpler and more manageable method using high electric field strength to compress the ionized atoms to get sufficiently close in order for nuclear fusion to occur; high temperatures is not needed. An ideal way to have electric compression of a plasma would be to have the plasma within a metal sphere where there is a symmetric electric field developed directed inwards towards the center; if it were possible, the electric field strength at the center would be infinity. But such an electric field configuration cannot be produced as it would mean a singularity at the center which violates Gauss's law for the electric field. So our design goes for the next best way to achieve the highest electric field strength at the center of the metal fusion sphere.

As can be seen in figure (1), the basic design is very simple. The device consists of a hollow conducting metal sphere acting as an anode connected to a high voltage DC source. The cathode is a sharp conducting metal needle piercing the sphere with the tip at the center of the sphere. It is known that the strongest electric field in our device is at the tip of the needle. Using a sharp pointed cathode has a weakness as it would be the very strong electric field around the sharp point that would likely cause discharge of electrons; it may even cause arc discharge to commence and this is not wanted. What this device aim at is to just have as high an electric field as possible at the center; this requires the highest voltage DC source applied without causing arc discharge. For this, cold temperatures may be more conducive as low temperatures generally inhibits the emission of cathode ray electrons.

This new design for a fusion experiment is not encouraged by any new insight into the physics of how hydrogen to helium fusion works, but rather on the acknowledgment that there are more about the process that we do not know then of what we know. Many important discoveries in physics happen through accidents. The most famous being the 1820 discovery by Oersted that an electric current affects magnetism; and an accident means there was no prior hint to the discoverer to pursue experimentation in a certain direction. As there is a lack of progress in fusion of hydrogen with high temperatures, we should even attempt the unexpected domains - of cold temperature fusion.

5. Conclusion

No one can propose a new design concept for an experimental fusion reactor and says how the new direction would very likely bring about the age of fusion energy. What can safely be said is that, as compared to the cost for the ITER project, the cost of trying out this design would cost next to nothing. The design should also be simple enough that most physics research laboratories would have access to the equipment and technology to conduct experiments along the direction of this new design concept.

References

[1] Chan Rasjid Kah Chew. The Relativistic Mechanics of E=mc2 Fails. http://vixra.org/abs/1810.0005
[2] Chan Rasjid Kah Chew. Nuclear Binding Energy Fails (Is Mass Spectrometry Accurate?) http://vixra.org/abs/1809.0491
[3] Chan Rasjid Kah Chew.Coulomb Electric Gravity And A Simple Unified Theory (SUT) http://vixra.org/abs/1808.0211

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