Cold Fusion: A False Hope as the Source of Energy

Karunakar Marasakatla
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(www.kmarasakatla.com)

Abstract

The notion of extracting enormous amounts of energy from a cold fusion nuclear reaction is based on the flawed fundamental concepts such as the definition of mass and the binding energy. A critical analysis of these concepts reveals that the cold fusion is nothing but a mirage and a misguided notion. However, it is possible to extract small amounts of energy in non-fusion nuclear reactions at room temperature.

Keywords: transitive property of equality, neutron star, binding energy, singularity, black hole, cold fusion, plasma and low energy nuclear reactions.

Introduction

There were many claims and counter claims in regard to the cold fusion in the history of science. For a long period of time, it has been thought that the solution for the energy needs of the future is in achieving the cold fusion by simply using the hydrogen gas at the room temperature. We get very limited amount of energy in the combustion of the hydrogen gas, whereas if we use the same amount of hydrogen in an apparent cold fusion reaction, we are supposed to get abundant amount of energy sufficient enough to power the energy needs of the world for billions of years into the future. Until now, all the attempts at achieving the cold fusion were consuming more energy than the energy released. Why we weren't able to achieve the cold fusion for all these years? Is it really a possibility or simply a figment of the imagination?

If at all the cold fusion ever possible, we should have achieved it by now due to our tremendous technological developments in the modern age. Then, why there were always claims and counter claims together whenever we hear the about the cold fusion in the news? That is because of our premises in understanding the fusion such as the definition of mass, mass deficit and the binding energy were not correct. It will never be possible to get more energy out of hydrogen gas at room temperature in an apparent cold fusion reaction.

Validity of Definition of Mass

According to the Transitive Property of Equality in Mathematics, if $a = b$ and $b = c$ then it will be $a = c$. Even though the Mathematics is the basis for the field of Physics, this property doesn't appear to be true in Physics.

Lets assume that the stars A and C with a mass of m_a and m_c collapsed to form two neutron stars B and D with a mass of m_b and m_d respectively. According to the definition of mass, an object's mass will remain same irrespective of its size. It means that the stars and their neutron counterparts will measure the same amount of mass. Therefore $m_a = m_b$ and $m_c = m_d$. According to the same definition of mass, two identical objects will measure the same amount of mass. If both the two neutron stars contain the same number of neutrons then they both will measure the same amount of mass. In this case, m_b will be equal to m_d.

Here, we have $m_a = m_b$ and $m_d = m_c$. Because $m_b = m_d$, we can say that $m_a = m_b$ and $m_b = m_c$, therefore, according to the Transitive Property, m_a should be equal to m_c. It means that the mass of two stars will be the same if the number of neutrons in those two stars are same. In reality, this is not true. Two different stars will measure different amount of mass depending upon the elemental composition of the stars, not on the number of neutrons they contain.

Definition of mass, the very fundamental concept in Physics violates the basic laws of Mathematics. Flawed definition of mass is the sole culprit for the present chaos in physical theories. Mass or gravity of an object does change with the size of the object [1]. Either if it is star or a nucleus of an atom, the compact form of the object measures more mass than the expanded form of the object with same amount of material. A neutron star measures more mass than any object from which it was collapsed.

This flawed definition of mass became the basis for many false assumptions in physics. One such being the extraction of energy from the fusion of hydrogen atoms at room temperature. Does the cold fusion will ever release more energy than it consumes? Lets look at the relation between the binding energy and the deficit of mass before exploring the feasibility of cold fusion as the energy source for the future.

Relation between the Binding Energy and the Size of a Nucleus

The relation between the mass, binding energy, deficit of mass and the size of a nucleus was grossly misunderstood. The mass of all the baryons in a nucleus will be greater than the mass of the nucleus of any element. The difference between them is what termed as the mass deficit and that deficit of mass was equated to the binding energy within the nucleus using the mass-energy equivalence principle of $E = mc^2$. According to the present theories, a nucleus will be compact when there is more and more binding energy within that nucleus. It means, a nucleus which exhibits more amount of deficit in mass will have more binding energy and forms as a compact nucleus. The relation between the deficit of mass and the size of a nucleus is a derived notion, not a direct observation. If we use the deficit of mass or binding energy within a nucleus to determine the the volume of that nucleus and how far away each nucleon is from one another then that will lead to wrong conclusions.

If all the mass was deficit in a nucleus then that nucleus will have tremendous amount of binding energy, making the object as the most compact form of material, possibly as a singularity or black hole. It means, the black hole is the lightest form of a material, the mass of any black hole being almost equal to zero kilograms because all of its mass was deficit. The idea of black hole being massless is unthinkable in the current theories of Physics. Black holes or the singularity does have a non zero amount of mass because many objects were bound to these black holes gravitationally such as the super massive black hole at the center of our Milky Way galaxy.

Even the other way around for the deficit of mass doesn't appear to be true. If the object has less deficit in mass, it will have less binding energy and occupies more in space. It means an expanded form of an object measures more in mass to its compact and denser counterpart. The concept of binding energy advocates that the size of the object or the amount of space the matter occupies will be proportional to the amount of mass it measures. In other words, the volume of the object is inversely proportional to the amount of deficit in mass that object exhibits. If this is true, a gaseous form of CO_2 should measure more in mass compared to the dry ice formed from the same amount of CO_2 molecules. Even this conclusion is in stark contrast to the definition of mass according to which the mass of an object should not vary depending upon the size of the object.

There is no consistency between the physical aspects such as mass, deficit of mass, binding energy and the volume of an object. All of our assumptions and theories based on the current definition of mass appears to be flawed. The best way to describe the observations coherently is that the mass or gravity of an object increases as all the matter within the object collapses to a compact form. The gravity of the same object will decrease as the distance between the particles increases and at the same time the gravitational self energy of the object also decreases. The difference in the gravitational self energy between the two forms of the object will be released as energy [2].

Strength of an object doesn't depend upon the density of the material with which the object was made of, rather it depends upon the structure of the material within the object. Shape and structure of same amount of carbon atoms in graphene or diamond determines the strength of the object. Same amount of bricks results in different amount of strength for a structure depending upon on whether those bricks were arranged in an arch or flat form. Aerogel made from carbon is stronger than any other object formed from the same amount of carbon atoms. Just like the diamond, Aerogel's strength comes from the structure of the material. Water is in more compact form compared to the ice formed from the same amount of H_2O molecules but the ice is more stronger than its compact counterpart. Usually, the strength of the object comes from the state of equilibrium within the object. An object with strong binding energy be not necessarily a compact object. There is no established relationship between the size and binding energy of an object. Principles of Physics should be universal and be the same for macro and micro worlds. Increase in the binding energy is not an indication to the compactness of the nucleus. Binding energy depends upon the structure in which all of the baryons form within a nucleus. It is a well known fact that the iron has more binding energy than any other nucleus but that doesn't mean it has one of the compact nuclei. The most probable cause for the iron to have more binding energy is the structure of its nucleus. The cause of increased deficit in iron is due to the increased volume in which all of its baryons were occupying. Nucleus of iron has more deficit in mass, more binding energy and will have increased distance between the baryons causing it to have less amount of gravitational self energy.

Nucleus of heavy elements like the uranium will have less deficit of mass, less average distance between the baryons

and more gravitational self energy. Disintegration or expansion of this nucleus releases the energy and results in the deficit of the combined mass of resultant products.

Differences between the Plasma and Hydrogen Gas

It is widely believed that the source of Sun's energy is the fusion of plasma, the hydrogen nuclei, into lighter elements. The amount of mass that was deficit in the reaction was equated to the amount of energy released. Plasma is a densely packed group of protons, completely different from the gaseous state of hydrogen found at the room temperature. Due to the compact nature of the plasma, it will have more self energy than the hydrogen gas for the same amount of protons. As the plasma expands when it forms as the nuclei of other elements, it releases the energy. Normal hydrogen atoms are already in an expanded form as a gas at the room temperature. They can't release any more energy when they are subjected to any kind of nuclear reactions. To make the hydrogen atoms to release energy, first we need to compress the atoms to the state of plasma and then that plasma should be subjected to an expansion. Energy will be consumed in the compression of the gaseous hydrogen before it ever releases the energy. Even if we achieve any form of nuclear reaction at room temperature, it will only release less amount of energy. In any form of reaction, the amount of energy being released will depend upon the amount of increase in the average distance between the particles within the initial material after the reaction.

Possibility of Cold Fusion

All the lighter elements such as hydrogen are found in the nature in a gaseous form. Unless this material was compressed to a compact form, there is no possibility of extracting the energy from these lighter elements. The fusion as we know it today is a two phase process; a collapse of the initial material to a compact form and the rearrangement of the compact material in different nuclei in an expansion. The initial phase consumes the energy and the later phase releases the energy. The net result depends upon the amount of initial collapse and the later expansion. It is absolutely not possible to release the energy without first consuming the same.

The concept of cold fusion is like a mirage, never existed in reality. It was born out of false fundamentals. It is very unfortunate that we are still hoping to achieve it one day to compensate the ever growing energy needs of the world. The cold fusion was even listed as one of the grand challenges for the humanity to resolve to succeed in the future [3].

Low Energy Nuclear Reactions

In any nuclear reaction, the net amount of energy depends upon whether there is a collapse or expansion in the final products. If there is an increase in the average distance between the particles of initial nucleus to the final nucleus by acquiring a proton or neutron, then the process should release the energy. The recent observations of non-fusion Low Energy Nuclear Reactions (LENR) might fall into this category. If a tightly packed nucleus converts to a loosely packed nucleus by acquiring a proton or neutron, then that process will release energy. There is no need for the collapse and expansion of the material like in the process of fusion. The only thing required for a reaction to release the energy is the net expansion of the material. The initial and the final nuclei could be the isotopes of same element or the nuclei of completely different elements.

Conclusion

The notion of cold fusion was born out of flawed fundamental concepts. An expanded and collapsed form of an object are not the same. Compact form of the object contains more energy than the expanded form of the same object with same amount of material. A compact form of an object can only release the energy when it was subjected to an expansion. There is no collapse of the material in a cold fusion using the Hydrogen gas at the room temperature, therefore the process will never release any net energy. Plasma, a compact form of hydrogen gas, can only release energy when it is subjected to an expansion. It is also possible to extract small amounts of energy from non-fusion nuclear reactions where there is a net increase in the average distance between the particles of initial and final nuclei.

The state of the present Physics is a conglomeration of blind beliefs, tricky conclusions and circular notions. The causes for all of these scenarios are the flawed, baseless, mathematically invalid fundamental concepts such as the mass and the binding energy.

References

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