An Unifying Basis for all the Nuclear Reactions

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Abstract

A successful explanation of the actual underlying physical process for an observed phenomenon will lead to the prediction of other possible scenarios for that process. A new understanding of how the nuclear reactions such as the fission and fusion works leads to the explanation of other observed anomalies. All the nuclear reactions, including the low energy nuclear reactions, appear to be the manifestation of the collapse and or expansion of a group of particles.

Keywords: transitive property of equality, neutron star, singularity, black hole, binding energy, strong nuclear force, gravitational self energy, mass energy equality, nuclear fission, nuclear fusion, plasma, cold fusion and low energy nuclear reactions.

Introduction

For a long period of time, it has been thought that the solution for the energy needs of the future is in achieving the nuclear fusion, similar to the fusion process taking place in the Sun, by simply using the hydrogen gas. We get very limited amount of energy in the combustion of the hydrogen gas, whereas if we use the same amount of hydrogen in a fusion reaction, we are supposed to get abundant amount of energy. If we could able to control the fusion reaction, it was claimed that it is possible to generate enough energy to power the energy needs of the world for billions of years into the future with the amount of available hydrogen on the planet. Until now, all the attempts at achieving the fusion were consuming more energy than the amount of energy being released. Why we weren't succeeded for all these years in devising a process for the fusion of hydrogen to power the world? Is such a process really a possibility or simply a figment of the imagination?

Another oddity in nuclear reactions is our inability to explain the cause for the energy released in apparent low energy nuclear reactions. Inability to explain doesn't invalidate a practical observation. Instead of ridiculing the observations, we need to look into our existing theories for any possible inconsistencies or misconceptions.

It does appear that we have abundant amount of inconsistencies in our understanding of this physical world. The very basic premises in our understanding of nuclear reactions such as definition of mass, mass deficit and the binding energy appear to be flawed.

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.

Let's 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 initial 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 is same. In reality, this conclusion 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 other object from which it was collapsed.

Binding Energy and the Size of a Nucleus

The relationship 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 these two was termed as the mass deficit and it 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 increased amount of deficit in mass will have more binding energy and forms as a compact nucleus. The relationship between the deficit of mass and the size of a nucleus is a derived notion, not a direct observation. It will lead to all false conclusions if we use the deficit of mass or the binding energy within a nucleus as basis to determine the volume of that nucleus and how far away the nucleons are from one another.

If all the mass becomes deficit within a nucleus then that nucleus will have tremendous amount of binding energy; transforming it 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 stars around 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 that statement is true then 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 appear to be flawed. The most appropriate description of 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 [1,2].

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 will result in different amount of strength for a structure depending upon whether those bricks were arranged in an arch or a flat form. Aerogel made from carbon is stronger than any other collapsed form of object made from the same amount of carbon atoms. Just like the diamond, Aerogel's strength comes from the structure of the material. Water is in compact form compared to the ice formed from the same amount of H_2O molecules but the ice is stronger than its compact counterpart. Usually, the strength of an object originates from the state of equilibrium within the object in a lattice or crystalline structure. An object with strong binding energy be not necessarily a compact 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. There is no direct relationship between the size and binding energy of a 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 plausible explanation 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 [1]. Nucleus of iron has more deficit in mass, more binding energy and will have increased distance between the baryons.

Energy within the Nuclear Reactions

The flawed definition of mass and the misunderstanding of the binding energy lead to many false conclusions in Nuclear Physics including the main factor by which the energy is released in these reactions. Gravity between two stars will increase when both the stars collapse to form neutron stars. Gravity will further increase when these two neutron stars collapse to form black holes. Inverse square law of gravity doesn't incorporate the size of an object into the picture. When definition of mass itself is flawed then the inverse square law for gravity is also becomes invalid.

A compact object, either it is a nucleus or a black hole, measures more in mass and gravity, and contains more energy. Gravity between two objects is stronger when they are of compact form such as two point size particles. In the absence of additional strong force between the particles, it was theorized that the gravity itself is the strong nuclear force [1, 2]; only the theories describing them are different until now. A compact object contains more energy in the form of gravitational self energy and measures more in mass and gravity. A compact form of an object means that all the particles within that object are close to each other. As the object expands, by increasing the distance between the individual particles, the gravitational self energy of the object decreases and at the same time it also measures less in mass and gravity. The difference in the gravitational self energy between the two forms of the object will be released as the energy in the expansion of the object. In any form of reaction, the amount of energy being released will depend upon the amount of increase in the average of average distance between one particle to the rest of the particles within the initial and final form of the object for all the particles combined.

Nuclear Fission

Nuclear fission is a process of splitting a nucleus of a heavy element into nuclei of two lighter elements. The amount of energy released in the process was equated to the amount of mass that was deficit in the process [3].

Uranium and all other heavy elements are known to have less binding energy per nucleon than the nucleus of the iron atom. Natural decay or the fission of heavy elements releases the energy until they form as the nuclei of an element with more binding energy such as iron. The notion of a nucleus of a heavy element with a less binding energy giving rise to a nuclei with more binding energy and still releases the energy, equal to the amount of mass that was deficit in the process, defies the logic. The sum of the binding energy of the products and the energy released will be more than the binding energy of the heavy element.

In accordance with the above findings, we can describe the nuclear fission as the expansion of a compact nucleus. 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 by fission or by radioactive decay releases the energy and results in the deficit of the combined mass of resultant products.

Nuclear Fusion

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 within our star, tremendous amount of energy was consumed initially in converting the hydrogen into a compact form of plasma. Energy is now being released from the plasma when it expands in forming the helium nuclei.

Just like the neutron star is a compact form of neutrons, the plasma is a compact form of protons. How much of binding energy these objects exhibit? According to the standard theories, the binding energy of these two objects is simply a zero because we don't propose any loss of mass in these objects yet they are very tightly bound compact objects.

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 into 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 in a fusion process. All the lighter elements such as hydrogen are found in the nature in a gaseous state. Unless this material was compressed to a compact form, there is no possibility of extracting the energy from these lighter elements.

The energy released in the fusion of deuterium with tritium creating helium is from the collapsed material of deuterium and tritium; it has nothing to do with the deficit of mass in the in the initial material. It is also possible to extract different amount of energy using the same amount of material in a fusion process. The amount of energy released depends upon the amount of collapse in the initial material. The mass energy equivalence principle, $E = mc^2$, takes the initial and final products into the picture and ignores the intermediate collapsed form of the material. The actual amount of energy released in a fusion depends upon the volume of the intermediate collapsed material and that could vary depending upon how much energy is used to compress the material. Energy inequality in fusion reactions and the flawed definition of mass are indications to the invalidity of the principle of mass energy equality in nuclear reactions.

Are There any Other Possibilities in Nuclear Reactions?

As it was mentioned earlier, the fusion is a two phase process; without the initial collapse of a material, it is not possible to release more energy in the process. Even though the earlier [4] and the more recent [5] observations of palladium-deuterium reactions revealed the possibility of excess energy in the nuclear reactions, these reactions wouldn't fit the description of either the fission or fusion processes. It was unfortunate that the process was termed as the cold fusion, hoping it to be a variant of nuclear fusion process. If not fission or fusion, what are these nuclear reactions if at all they are of type nuclear?

In any nuclear reaction, the net amount of energy depends upon whether there is a collapse or expansion in the material. If there is a net increase in the average distance between the particles of initial nucleus to the final nucleus by acquiring a proton or neutron, then that process will release the energy. If a tightly packed nucleus expands 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. This process is more akin to the fission process than to the fusion; where the nucleus expands but not to the extent of becoming the two different nuclei.

These experimental observations were never gained any credibility even after changing the name to Low Energy Nuclear Reactions (LENR). It is because the standard theories explaining the nuclear reactions were based on the false fundamentals. That made it difficult to comprehend these observations based on the prevailing theories.

Conclusion

Even though we generate enormous amounts nuclear energy for the benefit of the world, we haven't understood the underlying physical processes which are the basis for these nuclear reactions. Expanded and collapsed forms 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. It is also possible to extract small amounts of energy from non-fusion and non-fission nuclear reactions where there is a net increase in the average distance between the particles of initial and final nuclei. The notion of extracting enormous amounts of energy by simply using the hydrogen gas in a fusion reaction to power the world is baseless. The cause for all of the unrealistic assumptions is the flawed, baseless, mathematically invalid fundamental concepts such as the mass and the binding energy.

References

1. K Marasakatla, ***What Causes the Mass to be Deficit inside a Nucleus?***, Prespacetime Journal, Vol 1 No. 9, 1418-1424 (2010). [Available online at http://www.prespacetime.com/index.php/pst/article/view/123]
2. K Marasakatla, ***Gravity from a New Angle*** (2009).
3. L. Meitner and O.R. Frisch, ***Disintegration of Uranium by Neutrons: a New Type of Nuclear Reaction***, Nature, Vol. 143, No. 3615 (February 11, 1939).
4. M Fleischmann, et al., ***Calorimetry of the palladium-deuterium-heavy water system***, Journal of Electroanalytical Chemistry 287:

293–348 (1990)
5. P Mosier-Boss et al., *Triple tracks in CR-39 as the result of Pd–D Co-deposition: evidence of energetic neutrons*, NATURWISSENSCHAFTEN, Vol. 96, No. 1, 135-142 (2009)

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