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Nuclear Particles – A Wave Based Approach

1. Introduction

In the concurrent theories of nuclear physics particles, ie. protons /quarks and neutrons are considered as discrete and more or less point-like objects. Despite of large amount of experimental data collected during the last century, there are still many open issues, especially the origin of huge nuclear forces and (small) electric charge of a proton, as well as the mechanism behind the so called ”cold fusion” phenomenon that has been observed experimentally since 1989.
In the present framework the nuclear particles (proton /quarks, neutron) are described as standing wave structures in space medium. This concept is in line with the wave structure proposed for an electron in Ref [1], ie. the article published by the author in March/April 2013: ”Electromagnetic Phenomena – A Wave Based Approach”. A more comprehensive description of author's physical framework is given in Ref [5].

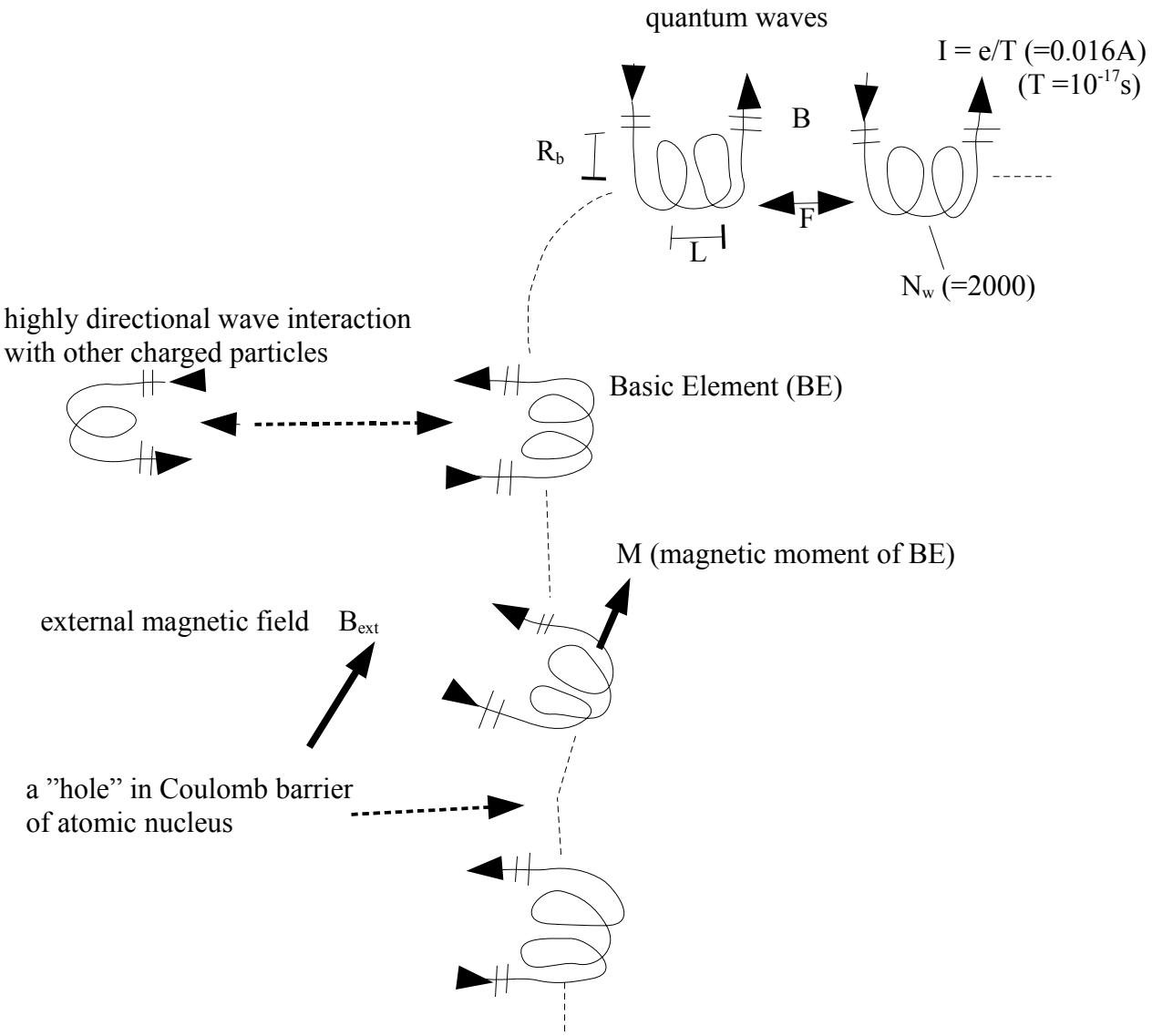
2. Proton

Lets assume the existence of an ether-like medium of space [5]. Spatial inhomogenities in ether's density may cause turbulent flow of ether substance that will lead to a creation of very small but intense ”eddies”. In sufficent conditions those eddies could form spatially periodic wave structures that we call ”elementary particles”, ie. protons /quarks, neutrons, electrons, positrons...

The scenario shown in Fig.1. presents the process of creating protons. The first step is called herein ”Basic Element” (BE), and the mechanism of producing a BE is basically similar to that of an electron: BE is a standing wave structure created by the quantum waves propagating in space medium. However, in case of a BE local medium density shall be extremely high, in terms of refractive index (n) it may be of the order of $10^5 – 10^6$, ie. about 1000 times higher than for electrons, this high medium density is to explain a high mass and energy involved in nuclear particles. Another specific feature of BE, as envisioned in this scenario, is its disc-like shape, instead of a spherical one that is assumed for electrons. Hence, a BE can be considered as a coil with multiple windings. Its mass (m_e) /energy and the magnitude of electric charge (e) are assumed to be similar to those of an electron.
To proceed, we can assume that a large number of BEs is produced in a relatively small volume of space. Due to the circulating charge of +e (ie. electric current I) in the structure of each BE, adjacent BEs are subjected to an attractive magnetic force F, which means that BEs tend to form a chain, as shown in Fig.1.a. It is assumed herein that a chain of BEs can include totally 1842 BEs, this means that the mass and energy involved is 1842 times that of an electron. Furthermore, it is expected that the chain system tries to find the state of its minimum energy. An ”educated guess” is that the tetrahedron structure shown in Fig.1.b may be relevant and stable solution herein [2]. Now we can state that each of the three faces of the tetrahedron represents a ”quark” of a proton.

(Fig.1)

a) A chain of basic elements (BE)



b) proton (p^+)

c) neutron ($n^0 = p^+ + e^-$)

Tetrahedron structure: a chain of 1842 Basic Elements (BE)

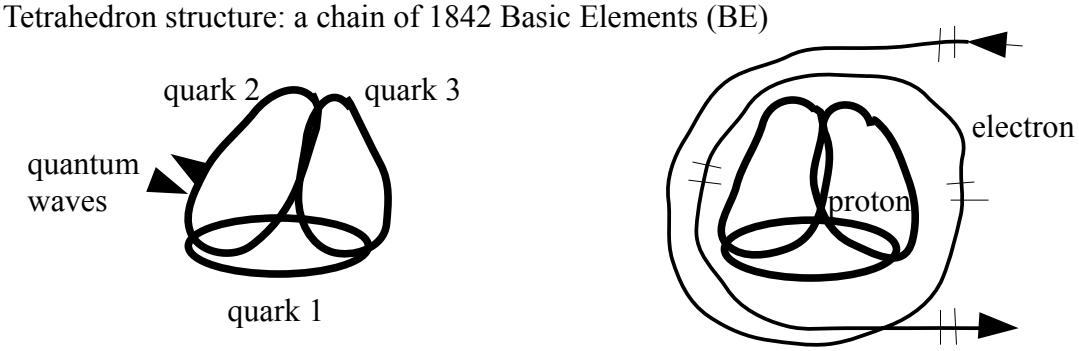


Fig.1: Creating proton /quarks and neutron - scenarios

In textbooks of electrical engineering we can find the following formulas (1) and (2) to estimate the attractive force F and the magnetic flux density B between adjacent Basic Elements (BEs):

$$F = B^2 A / 2\mu_0 \qquad (1)$$

$$B = \mu_0 N_w I (R_b^2 + L^2)^{-1/2}/2 \qquad (2)$$

where

R_b = radius of BE = $3x10^{-18}$ m, as assumed herein
A = cross section area of BE = πR_b^2
L = length of BE = $3x10^{-18}$ m, as assumed herein
I = electric current flowing through BE = e/T = 0.016A (T = 10^{-17} s, travel time through BE)
N_w = number of windings in a BE = 2000, as estimated herein
μ_0 = magnetic permeability of vacuum = 1.36 x 10^{-6} mkgC^2
e = elementary charge = 1.60 x 10^{-19} C

By using the formulas (1) and (2) above we can calculate an estimate for the attractive force F = 2.8 x 10^{-4} N. As the number of BEs in a chain (of proton) is assumed to be 1842, the total force between any of two adjacent BEs will be 1842 x F ~ 0.5N , ie. of the order of one Newton (!). Although this is just an approximate figure, it is easy to understand why protons are very stable particles.

One classic question is why proton's electric charge is just +e , ie. the same magnitude as electron's charge -e , although protons mass and energy are 1842 times those of electron ? If we take a look into Fig.1. a , we realise that the wave interaction of a single BE is highly directional. This means that an external observer, eg. electron or proton, can perceive effectively only the charge +e of one BE while making experiments with a proton, other BEs of the proton may of course be interacting with other observers at the same time.

3. Neutron

In this scenario it is assumed that a neutron (n^0) is a combination of a proton (p^+) and an electron (e^-), ie. $n^0 = p^+ + e^-$, as shown schematically in Fig.1.c where a proton has captured an electron, or vice versa. Neutron's electric charge is apparently zero, as proton's charge +e and electron's charge -e seem to compensate for each other. From wave mechanical point of view we can say that in neutron two waves are circulating with opposite phase (or polarity), and therefore an external observer can not see any electric charge there.

4. Cold fusion aspects

Cold fusion is considered here as a process where a proton, or Hydrogen (H) nucleus, penetrates into nucleus of a heavier atom, typically a metal, eg. Nickel (Ni). As a consequence, some energy is released in the form of excessive heat [3] [4]. Basically ”cold fusion” is a nuclear reaction that may occur at a moderate temperature, say 1000 ^{0}C, this is in high contrast with ”hot fusion” that needs extremely high temperatures, say one miljon ^{0}C .

Since 1989 many cold fusion experiments have been conducted in different places and by independent teams [3] [4]. However, there is still one fundamental theoretical question to be answered:
As there is a Coulomb barrier surrounding the metal nucleus concerned, how can a positively charged proton (Hydrogen nucleus) travel to that metal nucleus (Ni, eg.) ?
Now we can take a look into Fig.1.a : An external magnetic field B_{ext} is applied to the metal nucleus, this will cause a small deviation in the orientation of (some) Basic Elements (BE) in protons of the metal nucleus. When this happens, a (small) ”hole” is opened in the Coulomb barrier of the metal nucleus. Sufficiently heated (ie. under pressure) Hydrogen nuclei could now travel to the metal nucleus, and cause so called cold fusion reaction there.
In principle, there are different ways to produce the external magnetic field B_{ext} , or ”electromagnetic stimulus”: using dc- / ac-current, or eg. a laser source with sufficient power and frequency.

One of the latest cold fusion experiments is described in Ref [4]. In fact, it is a third party project where E-Cat reactor was tested (in March 2014) in Switzerland by a team of six researchers from Italy and Sweden. The test lasted continuously 32 days. The fuel used in E-Cat was hydrogen-loaded nickel powder plus some additives, mainly Lithium (Li). The total weight of the fuel was 1 gram. During the test run the produced net heat energy (1.5 MWh) was about 3.5 x the electrical energy fed to the E-Cat . The isotopic composition (Ni, Li) of the fuel was analyzed before and after the test run. There was a dramatic change in the isotopic composition, this tells that the fuel had undergone nuclear transformations. It is also essential that the total energy produced during the test run was many decades higher than that of the conventional chemical energy sources. No neutron or gamma emissions were observed and no radioactive waste was produced in the test run. It seems that cold fusion has an opportunity to provide us so called ”green energy”.

5. Discussion, conclusions

The wave based approach presented in this study is to explain the huge magnitude of nuclear forces having electromagnetic origin, and why proton's electric charge is just +e , and what could be the mechanisms behind the experimentally verified cold fusion phenomena.
There are still many items that were not discussed: Eg. can the proton and neutron scenarios presented meet the requirements of the ”least action” principle [2] , and could a single circulation of wave in a Basic Element represent a neutrino ? Furthermore, how protons and neutrons are located in an atomic nucleus ? Anyway, its clear that medium density in nucleus shall be very high, much higher than that of electrons. Interaction mechanisms between atomic nucleus and electrons ”orbiting” in electrosphere deserves its own study by using a wave based approach. Perhaps a modified coulombic model may be needed herein to explain why electrons do not fall into nucleus - could an electron approaching the nucleus ”screen” the proton and decrease the Coulomb force gradually and thus prevent a collision of orbital electrons with the nucleus...?

References:

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[5] Tapio Kulmala: ”Postulating ether as source for particles and medium for waves”, a booklet of 39 pages in the home page of the author: http://jpovitasku.jimdo.com, December 2013