Santilli's hadronic mechanics of formation of deuteron1)

Sudhakar S. Dhondge

Citation: AIP Conference Proceedings **1648**, 510009 (2015); doi: 10.1063/1.4912714
View online: http://dx.doi.org/10.1063/1.4912714
View Table of Contents: http://scitation.aip.org/content/aip/proceeding/aipcp/1648?ver=pdfcov
Published by the AIP Publishing

Santilli'S Hadronic Mechanics of Formation of Deuteron[1]

Sudhakar S. Dhondge

S. K. Porwal College, Kamptee, Nagpur - 441 001, MS, India
***Email**: s_dhondge@hotmail.com*

Abstract. In the present communication a brief review of the structure of deuteron proposed by Professor Santilli [1, 2] and its physical properties have been presented. Although Deuteron is a simple molecule, quantum mechanics has been unable to explain its different properties like the spin, magnetic moment, binding energy, stability, charge radius, dipole moment, etc. However, the Hadronic Mechanics developed by Santilli and applied by him [1, 2] to deuteron has succeeded in explaining the above properties to the scientific satisfaction. Santilli proposed Deuteron as a three body system which could take care of all the insufficiencies of quantum mechanics.

Keywords: Quantum Mechanics, Nonlinear or nonlocal theories and models, Iso-Mathematics, Deuteron

INTRODUCTION

Deuteron is normally considered as the combination of proton and neutron and thus it is considered as a two body system by quantum mechanical bound state. Its high stability is to the tune of 2.2 MeV. The stability of deuteron plays a very important part of the existence of the universe. In Rutherford's conjecture, neutron is considered as the nuclear bound state of one proton and one electron. Santilli made Rutherford's conjecture of neutron a quantitative description based on his Hadronic Mechanics [3, 4, 5]. From hereon Santilli under the covering laws of Hadronic Mechanics has demonstrated and established that all nuclei and therefore all the matter at large are supposed to be composed of proton and electrons [3]. The conception of nuclei as quantum mechanical bound states of proton and neutrons remains valid but only as a first approximation.

INSUFFICIENCIES OF QUANTUM MECHANICS

Although quantum mechanics has been accepted as providing the final representation of nuclear structures, it has not been able to represent the following basic data of the simplest possible nucleus, the deuteron, namely:

1. Quantum mechanics has been unable to represent the stability of the deuteron. This may be due to natural instability of deuteron.
2. Quantum mechanics has been unable to represent the spin 1 of the ground state of the deuteron. The basic axioms of quantum mechanics require that the most stable bound state of two particles with the same spin is that with spin zero. No such state has been detected in the deuteron.
3. Quantum mechanics has been unable to reach an exact representation of the magnetic moment of the deuteron. After about one century of research, nonrelativistic quantum mechanics misses 0.022 Bohr units corresponding to 2.6
4. Quantum mechanics has been unable to identify the physical origin of the attractive force binding together the proton and the neutron in the deuteron. Since the neutron is neutral, there is no known electrostatic origin of the attractive force needed for the existence of the deuteron. As a matter of fact, the only Coulomb force for the proton-neutron system is that of the magnetic moments, which force is repulsive for the case of spin 1 with parallel spin.

---

[1] This work is being presented in the Workshop on Isomathematics and its Applications at 12th International Conference on Numerical Analysis and Applied Mathematics 2014 during 22-26 Sept., 2014 at Rodos Palace Hotel, Rhodes, Greece.

Proceedings of the International Conference on Numerical Analysis and Applied Mathematics 2014 (ICNAAM-2014)
AIP Conf. Proc. 1648, 510009-1–510009-4; doi: 10.1063/1.4912714

5. Quantum mechanics has also been unable to treat the deuteron space parity in a way consistent with the rest of the theory. The experimental value of the space parity of the deuteron is positive for the ground state, because the angular momentum L is zero.

DEUTERON AND HADRONIC MECHANICS

It is evident from the above facts that quantum mechanics has been unable to treat the deuteron space parity, in a way consistent with the rest of the theory [4, 1, 6]. Thus quantum mechanics has not been able to solve fundamental problems even for the case of the smallest possible nucleus, the deuteron, with progressively increasing unresolved problems for heavier nuclei.

It is known that the spin of the deuteron in its ground state is 1; the spin of the protons is 1/2; the spin of the isoelectron is 1/2; and that the mutated angular momentum of the isoelectron is 1/2. Taking into consideration the above facts Santilli assumed the structure of the deuteron as being composed of two un-mutated protons with parallel spins rotating around the central isoelectron to allow the triplet coupling, and then the two coupled particles in line have an orbital motion around the isoelectron at the centre, resulting in the first approximation in the following hadronic structure model of the deuteron [7].

$$d = \left(p^{+}_{\uparrow}, e^{-}_{\downarrow}, p^{+}_{\uparrow}\right) \tag{1}$$

Thus, proton is the only stable particle and neutron is unstable, comprising of proton and electron. Santilli assumed that nuclei are a collection of protons and neutrons, in first approximation, while at a deeper level a collection of mutated protons and electrons. It has been proved that a three-body structure provides the only known consistent representation of all characteristics of the deuteron, first achieved by R. M. Santilli.

Volodymyr Krasnoholovets has tried to resolve the above anomalies in his recent paper [8]. He analyzed the problem of the deuteron from the viewpoint of the constitution of the real space that is developing. He concluded that the nucleus does not hold the electrons in the orbital position and polarized inertons of atomic electrons directly interact with the nucleus. He also analyzed the problem of the motion of nucleons in the deuteron, which takes into account their interaction with the space and concluded that nucleons in the deuteron oscillate along the polar axis and also undergo rotational oscillations. In other words, the nucleons execute radial and rotationally oscillatory motions. Trying to account for the reasons for nuclear forces, he has analyzed major views available in the literature including QCD, quantum field theories, hadronic mechanics, and even the Vedic literature.

R. M. Santilli in 1998 provided the consistent representation of all the characteristics of the deuteron using its three body model [2] that involves isomathematics based methods of hadronic mechanics. His hadronic mechanics method explains the strong attraction between protons and neutrons via the Hulthén potential concept [9]. Thus the hadronic mechanics:

1. could successfully explain the experimental value of spin 1of the deuteron;
2. offered the exact and invariant representation of the total magnetic moment of the deuteron;
3. provided an physical insight into the deuteron size and charge.

It has been demonstrated by Santilli that the binding energy of the deuteron is due to the potential component of the deuteron binding force. He summarised that the isotopic branch of non-relativistic hadronic mechanics permits the exact and invariant representation of all the characteristics of the deuteron formed by two isoprotons and one isoelectron, at the same time resolving all quantum mechanical insufficiencies. It has been shown that charge radii of the two protons are separated by approximately 1.1 fm, namely, an amount that is fully sufficient, on one side, to allow the triplet alignment of the two protons. According to him, protons and electrons are permanently stable particles and the deuteron has no unstable particle in its structure and, consequently it is stable due to the strength of the nuclear force. Hence, the reduction of the unstable neutron to the permanently stable isoproton and isoelectron provides a direct and immediate interpretation of the stability of the Deuteron which is basically absent for quantum mechanics.

The "gear model" introduced by Santilli could illustrate the only possible stable couplings of three spinning particles when in conditions of mutual penetration, by therefore confirming the direct and invariant representation of the Deuteron spin 1 in a ground state with null angular momentum which is absent for normal model.

The exact and invariant representation of the total magnetic moment of the deuteron could provide the missing contribution provided by the total magnetic moment of the isoelectron. The numerical value of magnetic moment of isoelectron is given by the difference between the orbital and the intrinsic magnetic moment that is very small (per electron's standard) since the total angular momentum of the isoelectron is indeed small. It should be noted that the small value of the total magnetic moment of the isoelectron for the case of the deuteron is close to the corresponding value for the neutron.

Quantum mechanics merely provides numerous mathematical descriptions of the attractive force via a plethora of potentials, although none of them admits a clear physical explanation of the strong attraction between protons and neutrons. Whereas, Santilli's model represented by equation 1 permits a clear resolution of this additional insufficiency of quantum mechanics via the precise identification of two types of nuclear forces, the first derivable from a Coulomb potential and the second of contact type represented with the isounit. He could prove that the isoelectron cannot solely be restricted to exist within one of the two protons, because there exists a 50% isoprobability of moving from the interior of one proton to that of the other proton. Therefore, the proton-neutron exchange is confirmed by model 1 (Equation 1) and so is the attractive character of the related force.

It is well known, the binding energy of the deuteron is given by Ed = -2. 26MeV. According to hadronic mechanics that the binding energy is mainly characterized by forces derivable from a potential since the contact forces due to mutual wave-overlapping of wave packets have no potential energy. Hence, the binding energy of the deuteron is due to the potential component of the deuteron binding force. Hadronic mechanics also permits the exact and invariant representation of the total energy of the deuteron, that, as such, becomes another verification of model given by equation 1.

If it is assumed that the isoelectron spends 50% of the time within one proton and 50% within the other, thus reducing model given by equation 1 to first approximation to a two-body system of two identical particles with un-isorenormalized mass the main differences being given by numerical values for the energy, meanlife and charge radius. Santilli reaches in this way the structure equation of the deuteron in first two-body nonrelativistic approximation

$$d = \left(\hat{p}_{\uparrow}, \hat{p}_{\uparrow}\right)_{hm} \tag{2}$$

Then it is observed that in the above model, the deuteron binding energy is zero.

A more accurate description can be obtained via the restricted three-body configuration that, as such, also admits an exact solution. Santilli illustrated his conception of the structure of the deuteron as a restricted three body of two un-mutated protons (due to their weight) and one mutated electron. The model can be constructed via a nonunitary transform of the conventional restricted three-body Schrödinger equation for two protons with parallel spin 1/2 and one isoelectron with null total angular momentum with conventional Hamiltonian H = T + V (Coul.). The nonunitary transforms then produces an additional strong Hulthèn potential that can, again absorb the Coulomb potential resulting in a solvable equation.

The electric dipole moment of the deuteron is identically null. Its representation via hadronic mechanics follows from the fact that isotopies cannot alter null values. The positive parity of the deuteron is trivially represented by hadronic mechanics via the expression

$$Isoparity = (-1)^{\hat{L}} \tag{3}$$

and the value for the unperturbed deuteron in its ground state $\hat{L} = L = 0$.

Thus Santilli has shown that the isotopic branch of nonrelativistic hadronic mechanics permits the exact and invariant representation of all the characteristics of the deuteron composed by two isoprotons and one isoelectrons, while jointly resolving all quantum insufficiencies identified above.

Thus following the reduction of the neutron to a proton and an electron and the reduction of the deuteron to two protons and one electron, Santilli has achieved the important reduction of all matter to protons and electrons, since the reduction of the remaining nuclei to protons and electron is consequential, e.g., as a hadronic bound state of two mutated deuterons. Santilli further stated that the fact that the so-called neutron stars are in reality an extremely high density and high temperature fluid composed by the original constituents of the star, protons and electrons, in conditions of deep mutual penetration under the laws of hadronic mechanics.

ACKNOWLEDGMENTS

The financial support from *The Santilli Foundation* is gratefully acknowledged. Author is indebted to Professor R. M. Santilli for the encouragement and also to Professor A. A. Bhalekar for his valuable guidance to carry out this study.

REFERENCES

1. R. M. Santilli, *J. New Energy*, **Vol. 1**, 1, (1999). http://www.santilli-foundation.org/docs/santilli-114.pdf
2. R. M. Santilli, *Intern. J. Phys.*, **Vol. 4**, 1, (1998), http://www.santilli-foundation.org/docs/Santilli-07.pdf
3. http://www.thunder-funsion.com/scientific-summary.html; C. Ktorides, H. C. Myung and R. M. santilli, *Physical Review D*, **Vol. 22**, 892 (1980). http://www.santilli-foundation.org/docs/Santilli-16.pdf
4. I. Gandzha and J. Kadeisvily, *New Sciences for a New Era. Mathematical, Physical Discoveries of Ruggero Maria Santill*, Sankata Printing Press, Kathmandu, Nepal, 2011.
5. C. S. Burande, *Numerical Analysis and Applied Mathematics ICNAAM 2013 AIP Conf. Proc.* **1558**, 693 (2013); : http://dx.doi.org/10.1063/1.4825586 http://www.santilli-foundation.org/docs/burande.pdf
6. R. M. Santilli, *The Structure of the neutron as predicted by Hadronic Mechanics*, http://www.neutronstructure.org.
7. R. M. Santilli, *Intern. J. Phys.*, **Vol. 4**, 1, (1998). http://www.santilli-foundation.org/docs/Santilli-07.pdf
8. Volodymyr Krasnoholovets, *Scientific Inquiry*, **7(1)**, June 30, 25 (2006).
9. L. Hulthén, *Ark. Mat. Astron. Fys.*, **28A**, 5 (1942).