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# On the Experimental Verification of Rutherford-santilli Neutron Model<sup>1</sup>

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**Abstract.** Santilli strongly advocates Rutherford's conjecture [1] that neutron is a compressed hydrogen atom and has synthesized it using only a proton and an electron. He formulated its mathematical description through his novel isomathematics [2, 3] and corresponding hadronic mechanics [4], which resolved anomalies existing in the literature such as binding energy, spin and magnetic moment for bound state when electron is totally immersed within the hyper-dense medium inside the proton. He did not restrict himself at the conceptual level but duly verified experimentally the proposal of neutron synthesis. Rutherford's conjecture was first demonstrated by the Don Carlo Borghi and his team with their laboratory synthesis of the neutron from proton and electrons. However, the findings of the Don Carlo Borghi experiment were criticized by scientific fraternity due to the non-concurrence of his results with the existing framework of quantum mechanics. Despite the firm resistance by large number of laboratories, Santilli repeated the Don Carlo Borghi experiment and verified that the said setup indeed produces neutron-type particles called "neutroids" which latter is absorbed by the activated detector substances that produces known nuclear reactions. He dismissed the neutrino hypothesis and replaced it with a longitudinal impulse originating from the ether as a universal substratum, named, "etherino". He pointed out that all the physical quantities missing in the neutron synthesis, such as energy and spin, are delivered by said impulse.

**Keywords:** neutron, binding energy, isoelectron, etherino .

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## DON BORGHI EXPERIMENT ON THE SYNTHESIS OF NEUTRONS

The first experiment on the synthesis of neutrons from protons and electrons was conducted by Carlo Borghi, C. Giori and A. Dall'Olio in the 1960s at the CEN Laboratories in Recife, Brazil [5, 6]. Hydrogen gas at fraction of 1 bar pressure was obtained from the electrolytical separation of water and was placed in the interior of a cylindrical metal chamber (called klystron) and kept mostly ionized by an electric arc with about 500 V and 10 mA. Additionally, the gas was traversed by microwaves with 10s frequency. Suitable materials which are vulnerable to nuclear transmutation when exposed to a neutron flux, were placed exterior of the chamber. Following exposures of the order of days or weeks, the experimentalists reported nuclear transmutations that were based on the observed neutron counts of up to 104 cps. Don Borghi experiment has been strongly criticized by academia on pure theoretical grounds without the actual repetition of the tests. Note that experiment makes no claim of direct detection of neutrons, and only claims the detection of clear nuclear transmutations.

To verify the claim of Don Borghi's experiment, Santilli repeated this experiment in large number of laboratories and institutions the world over.

## SANTILLI EXPERIMENT ON THE SYNTHESIS OF NEUTRONS

Santilli conceived his experiment [7] as being solely based on the use of an electric arc within a cold (i.e., at atmospheric temperature) hydrogen gas without any use of microwave at all. Three different klystrons were manufactured, tested and used for the measurements. The specifications of detectors were used for measurements are given below:

1. A detector model PM1703GN manufactured by Polimaster, Inc., with sonic and vibration alarms as well as memory for printouts, with the photon channel activated by CsI and the neutron channel activated by LiI.

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<sup>1</sup> This work is being presented at ICNAAM 2013 being held at Rhodes, Greece during September 21-27, 2013.

2. A photon-neutron detector SAM 935 manufactured by Berkeley Nucleonics, Inc., with the photon channel activated by NaI and the neutron channel activated by He-3 also equipped with sonic alarm and memory for printouts of all counts. This detector was used to verify the counts from the preceding one.
3. A BF3 activated neutron detector model 12-4 manufactured by Ludlum Measurements, Inc., without counts memory for printouts. This detector was used to verify the counts by the preceding two detectors.

Electric arcs were powered by welders manufactured by Miller Electric, Inc., including a Syncrowave 300, a Dynasty 200, and a Dynasty 700 capable of delivering an arc in DC or AC mode, the latter having frequencies variable from 20 to 400 Hz.

Klystron-I was cylindrical and sealed, of about 6" outside diameter and 12" height, made of commercially available, transparent, PolyVinyl Chloride (PVC) housing along its symmetry axis a pair of tungsten electrodes. The electrodes gap was controllable by sliding the top conducting rod through the seal of the flange. The klystron cylindrical wall was transparent so as to allow a visual detection of arc. After initiation of DC arc there was no detection for hours. However, shaking of klystron the neutrons were detected in a systematic and repetitive way. The detection was triggered by a neutron-type particle, excluding contributions from photons. However, these detections were anomalous, that is, they did not appear to be due to a flux of actual neutrons originating from the klystron. This anomaly is established by the repeated "delayed detections," that is, exposure of the detector to the klystron with no counts of any type, moving the detector away from the klystron (at times for miles), then seeing the detectors enter into off-scale vibrations and sonic alarms with zero photon counts.

Klystron-II was a rectangular, transparent, made up of PVC of dimension . This klystron was small in size than earlier one to avoid implosion caused by combustion with atmospheric oxygen. This test was conducted only once because of instantaneous off-scale detection of neutrons by all detectors which led to evacuation of the laboratory. Hence, this test was not repeated for safety.

Klystron-III was cylindrical made up of carbon steel pipe with 12" outer diameter, 0.5" wall thickness, 24" length and 3" thick end flanges to sustain hydrogen pressure up to 500 psi with the internal arc between threated tungsten electrodes controlled by outside mechanisms. This test was conceived for the conduction of the test at bigger hydrogen pressure compared to that of Klystron I. The test was conducted only once at 300 psi hydrogen pressures because of instantaneous, off-scale, neutron detections such to cause another evacuation of the laboratory.

The main purpose of Santilli's of conducting these tests was to establish the production of neutron-type particles via a DC arc within a hydrogen gas. He has experimented identical tests with other gases, but no meaningful counts were detected other than hydrogen. No neutron, photon or other radiation was measured from electric arcs submerged within liquids. Hence, the reported findings appear to be specific for electric arcs within a hydrogen gas under the conditions stated above.

## **THE DON BORGHI-SANTILLI NEUTROID**

Santilli [4, 7] excludes that the entities produced in the tests with Klystron I are true neutrons for various reasons, such as:

1. The anomalous behavior of the detector, in the case of the 15 minute delay, namely the self-activated detection indicates first the absorption of "entities" producing nuclear transmutations that, in turn release ordinary neutrons.
2. The environment inside stars can indeed provide the missing energy of 0.78 MeV for the neutron synthesis, but the environment inside Klystron-I cannot do the same due to the very low density of the hydrogen gas.
3. The physical laws of hadronic mechanics do not allow the synthesis of the neutron under the conditions of Klystron-I because of the need of the trigger, namely, an external event permitting the transition from quantum to hadronic conditions. In fact, the tests with Klystrons-II and III do admit the trigger required by hadronic mechanics. However, Santilli did not discard that the "entities" produced in the tests with Klystrons-II and III are indeed actual neutrons, due to the instantaneous, off-scale nature of the neutron alarms in clear absence of photon or vibrations.

In view of above reasons, Don Borghi [5, 6] submitted the hypothesis that the "entities" are neutron-type particles called "neutroids". Santilli adopted this hypothesis and presented the first technical characterization of neutroids with the symbol,  $\tilde{n}$  and the characteristics in conventional nuclear units,  $A = 1$ ,  $Z = 0$ ,  $J = 0$ ,  $amu = 0.008$ . Hence, Santilli assumed that in Klystron-I, he produced the following reaction precisely along Rutherford's original

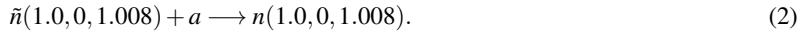
conception



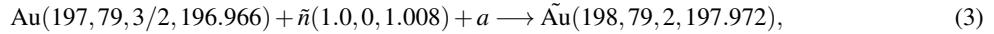
where the value  $J = 0$  is used for the primary purpose of avoiding the spin anomaly in the neutron synthesis as indicated above and the rest energy of the neutroids is assumed as being that of the hydrogen atom.

## INTERPRETATION OF DON BORGHI AND SANTILLI EXPERIMENTS

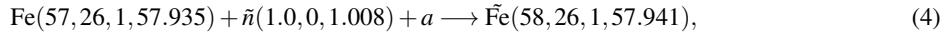
In Don Borghi's and Santilli's experiments the various substances placed in the exterior of the klystrons did indeed experience nuclear transmutations. If we discard the Don Borghi's klystron and Santilli's Klystron-I to produce actual neutrons, then the main question arises from where the neutrons originated and detected. Evidently, only two possibilities remain, namely, that the detected neutrons were actually synthesized in the walls of the klystrons, or by the activated substances themselves following the absorption of the neutroids produced by the klystrons. Considering the neutrino hypothesis has no sense for the neutron synthesis for various reasons, Santilli [8] assumes that the energy, spin and magnetic anomalies in the neutron synthesis are accounted for by their transfer either from nuclei or from the aether via his etherino hypothesis



Assuming the binding energy of a neutroid is similar to that of an ordinary nucleon (since neutroids are assumed to be converted into neutrons when inside nuclei, or to decompose into protons and electrons, thus recovering again the nucleon binding energy), Santilli indicates the following possible nuclear reaction for one of the activated substances in Don Borghi's tests

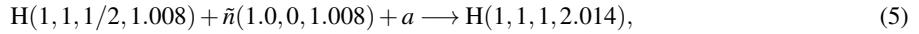


produces known nuclide, hence it indicates that neutrons were synthesized by the activating substances themselves on absorption of neutroid. The nuclear reaction with steel wall of the klystron,

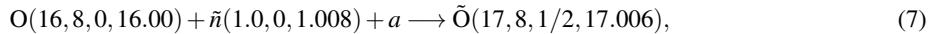
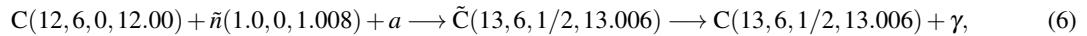


yields an unknown nuclide,  $\tilde{Fe}(58, 26, 1, 57.941)$  because the known nuclide is  $Fe(58, 26, 0, 57.933)$ . This indicates that the neutrons in Don Borghi experiment were not synthesized in the walls of his klystron. Eq.(2) also allow an interpretation of some of Santilli detections [4, 7], with the understanding that the anomalous behavior of the detectors, such as the delayed neutron counts, requires special studies and perhaps the existence of some additional event not clearly manifested in Don Borghi's tests.

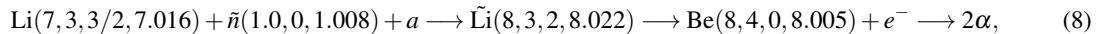
To initiate the study, Santilli considered the first possible reaction inside the klystron



delivers ordinary deuteron on coupling of hydrogen atom and neutroid. This indicates neutrons cannot be originated inside the klystron-I. Next, Santilli considered following nuclear reactions with the polycarbonate of Klystron-I wall containing about 75 percent carbon and 18.9 percent oxygen



do not give conventional activation processes. Thus, in Santilli's experiment too, it does not appear that the detected neutrons are synthesized by the walls of klystron. The above analysis leads us to the only remaining possibility that in Santilli tests, the neutrons are synthesized by the detectors themselves. To study this possibility, Santilli considered the reaction using Li-activated detectors,



that behaves fully equivalent to detection of neutriods or neutrons. This indicated that neutrons detected in Santilli experiment were synthesized by the substance used for detection after absorption of neutriods.

## CONCLUDING REMARKS

After successful mathematical explanation of Rutherford's conjecture on neutron synthesis through novel formulation of hadronic mechanics, Santilli ventured experimentation to strengthen his strong support to the Rutherford model. For experimentation, he adopted the methodology already conceived by Don Borghi and his team for synthesis of neutron from hydrogen atom. He never claimed the direct detection of neutron. He claimed the detection of neutron through nuclear transmutations. He never ruled out that the detected entities are only the neutrons. He proposed the emission of neutron like particle, named "neutriod", in Klystrons because direct production would require a trigger, which is absent in the experimental set-up. He interpreted the detection of neutron through the possible nuclear reactions by activated substances after absorption of neutriods. In nut-shell he concluded that evidently the neutrons detected in Don Borghi experiment were synthesized by the nuclei of the activated substances, while the neutrons of Santilli experiment were synthesized by the detectors themselves by their activating substance after absorption of neutriods.

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