

THE R.M. SANTILLI FOUNDATION

EXECUTIVE SUMMARY ON HYPERFUSIONS

Richard Anderson
Trustee
The R. M. Santilli Foundation
www.santilli-foundation.org

FOREWORD

The study on new clean nuclear fusions here reported was initiated in 1978 by Sir R. M. Santilli (Biographical Notes <http://www.i-b-r.org/Sir-Santilli-bionotes-05-15-21.pdf>) when he was in the faculty of the Lyman Laboratory of Physics of Harvard University under DOE contracts numbers ER-78-S-02-47420.A000, AS02-78ER04742, DE-ACO2-80ER10651, DE-ACO2-80ER-10651.A001, DE-ACO2-90ER10651.A002.

The biggest obstacle against the controllable and sustainable nuclear fusions is the "Coulomb Barrier," namely, the "repulsion" between positively charged nuclei which, for the fusion of two Deuterons into the Helium, reaches the astronomical value (for particle standards) of 230 Newtons.

Sir Santilli's research was focused, firstly, on the representation of the synthesis of the neutron from the hydrogen in the core of stars according to Rutherford (royalsocietypublishing.org/doi/10.1098/rspa.1920.0040) and then on the synthesis of electrons and natural nuclei, resulting in "negatively charged" nuclei called "PseudoNuclei" that are "attracted" by positively charged natural nuclei resulting in inevitable nuclear fusions without the Coulomb Barrier called HyperFusions..

The problem in implementing the above elementary ideas was that the syntheses of neutrons and PseudoNuclei are prohibited by quantum mechanics, and more particularly, by the experimentally unverified assumption that Heisenberg's uncertainty principle for point like particles in vacuum under electromagnetic interactions is equally valid for extended protons and neutrons under strong interactions.

Predictably, the achievement of maturity in the syntheses of neutrons and PseudoNuclei as well as their application to HyperFusions, required decades of mathematical,

theoretical, experimental and industrial studies due to the complexity of the underlying open problems including:

I. The representation of strongly interacting particles (called hadrons) as being extended, thus deformable under conventional action-at-a-distance potential interactions as well as contact, thus zero range and non-potential interactions
<http://www.santilli-foundation.org/docs/Santilli-209.pdf>

II. The axiom-preserving completion of quantum mechanics into a new mechanics, called by Sir Santilli hadronic mechanics, for the representation of nuclei as existing in the physical reality, that is, composed by extended-deformable nucleons in conditions of partial mutual penetration with ensuing potential and non-potential interactions
<http://www.santilli-foundation.org/docs/santilli-69.pdf>

III. The achievement of a generalization of Heisenberg's uncertainty principle for strong interactions between extended hadrons, first introduced by Sir Santilli in the 1981 DOE-recorded paper <https://www.osti.gov/biblio/6648552>.

The study then required the validity of the new mechanics for the first known, numerically exact and time invariant representation of nuclear data
<http://www.i-b-r.org/Elements-Hadronic-Mechanics.htm>
<http://www.santilli-foundation.org/docs/RM-Special-Issue-.Vol.-52-2024-compressed.pdf>

SREPRESENTATIVE PAPERS

1. Sir Santilli's generalization for extended hadrons under "strong" interactions of Heisenberg's uncertainty principle for point-like particles under "electromagnetic" interactions, see the summary paper:

[1] A. Muktibodh: Santilli's recovering of Einstein's determinism, *Progress in Physics*, in press (2024),
<http://www.eprdebates.org/docs/muktibodh-2024.pdf>
and the independent review by the British Journal Scientia
<https://www.scientia.global/the-progressive-recovering-of-einsteins-determinism-under-strong-interactions/>

2. Limitations of quantum mechanics in nuclear physics. Following the inability by nuclear physics to achieve sustainable nuclear fusions in 75 years and trillions of dollars of public funds, Sir Santilli and his associates have dedicated primary attention to the axiomatic insufficiencies of quantum mechanics in nuclear physics, see:

[2] R. M. Santilli: Lie-isotopic representation of stable nuclei I: apparent insufficiencies of quantum mechanics in nuclear physics, *Ratio Mathematica* **52** (2024), in press,
<https://www.santilli-foundation.org/docs/3-RM-SI-Vol-52-2024-fin.pdf>

3. The first studies dealt with generalized theories based in the mathematics of quantum mechanics, to discover that they are afflicted by catastrophic "physical" inconsistencies whose solution mandated the construction of hadronic mechanics, see the paper:

[3] S. Beghella-Bartoli, A. Muktibodh and R. M. Santilli: Problematic aspects of generalized quantum theories and their apparent resolution via hadronic mechanics, <https://www.santilli-foundation.org/docs/2-RM-SI-Vol-52-2024-fin.pdf>

4. First known numerically exact and time invariant representation of experimental data for "stable" nuclei in their true ground states, those without the usual "orbital" contributions for the spin:

[4] R. M. Santilli: Lie-isotopic representation of stable nuclei II: Exact and time invariant representation of the Deuteron data, *Ratio Mathematica* **52** (2024), in press, <https://www.santilli-foundation.org/docs/4-RM-SI-Vol-52-2024-fin.pdf>

5. First known numerically exact and time invariant representation of nuclear stability despite the natural instability of the neutron and despite extremely strong repulsive Coulomb protonic forces:

[5] R. M. Santilli: Lie-isotopic representation of stable nuclei III: Exact and time invariant representation of nuclear stability, *Ratio Mathematica* **52** (2024), in press, <https://www.santilli-foundation.org/docs/5-RM-SI-Vol-52-2024-fin.pdf>

6. Experimental verification that the neutron is a bound state of a proton and an electron as conceived by Rutherford:

[6] R. Norman, S. Beghella Bartoli, B. Buckley, J. Dunning-Davies, J. Rak, and R. M. Santilli, Experimental Confirmation of the Synthesis of Neutrons and Neutroids from a Hydrogen Gas. *American Journal of Modern Physics* **6**, 85-104 (2017), <http://www.santilli-foundation.org/docs/confirmation-neutron-synthesis-2017.pdf>

7. Numerically exact and time invariant representation of "all" the characteristics of the neutron as a hadronic bound state of a proton and an electron at the nonrelativistic and relativistic levels with ensuing confirmation of the historical conception of "stable" matter as being composed by the "permanently stable" protons and electrons:

[7] R. M. Santilli: Reduction of Matter in the Universe to Protons and Electrons via the Lie-isotopic Branch of Hadronic Mechanic. *Progress in Physics*, **19**, 73-99 (2023). <https://www.santilli-foundation.org/docs/pip-6.pdf>

8. Generalization of Galileo's and Einstein's special relativities for extended-deformable hadrons under potential and non-potential interactions, see the monograph from lectures delivered by Santilli at the ICTP, Trieste, Italy, in 1990

[8] A. K. Aringazin, Jannussis, A., Lopez, F., Nishioka, M. and Veljanosky, B. {it Santilli's Lie-Isotopic Generalization of Galilei and Einstein Relativities,} Kostakaris Publishers, Athens, Greece (1991),\ \ <https://www.santilli-foundation.org/docs/Santilli-108.pdf>

9. Video on the HyperFusion Reactor III, <http://www.world-lecture-series.org/dragon-iii> and a scientific paper on the experimental evidence of HyperFusions:

[9] R. M. Santilli, Apparent Resolution of the Coulomb Barrier for Nuclear Fusions Via the Irreversible Lie-admissible Branch of Hadronic Mechanics, Progress in Physics, {bf 18}, 138-163 (2022), <http://www.santilli-foundation.org/hyperfusion-2022.pdf>

