

January 15, 2021

MAIN REFERENCES ON
SANTILLI'S VERIFICATIONS OF THE EPR
ARGUMENT THAT "QUANTUM MECHANICS
IS NOT A COMPLETE THEORY

A. Einstein, B. Podolsky and N. Rosen,
"Can quantum-mechanical description of
physical reality be considered complete?,"
Phys. Rev. **47**, 777 (1935),
<http://www.eprdebates.org/docs/epr-argument.pdf>

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Prepared by the Editorial Team of EPR debates

Biographical data on

Sir Prof. Ruggero Maria Santilli

Video Curriculum

<http://www.world-lecture-series.org/santilli-cv>

Full Curriculum

<http://www.i-b-r.org/Ruggero-Maria-Santilli.htm>—

Awards and Nominations

<http://santilli-foundation.org/santilli-nobel-nominations.html>

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Quantum mechanics cannot represent energy-releasing processes because said theory is strictly reversible over time, while said processes are irreversible. Santilli published in 1967 his Ph. D. thesis at the University of Torino, Italy, on the Lie-admissible "completion" $(A, B) = A\hat{R}B - B\hat{S}A$, $\hat{R} > 0$, $\hat{S} > 0$ of the Lie algebra $[A, B] = AB - BA$ of quantum mechanics which provided his first verification of the EPR argument for the representation of irreversible energy-releasing processes via the irreversible completion of quantum mechanics into hadronic mechanics, see [1] :

[1] R. M. Santilli, "Embedding of Lie-algebras into Lie-admissible algebras," *Nuovo Cimento* **51**, 570 (1967),
<http://www.santilli-foundation.org/docs/Santilli-54.pdf>

While at Harvard University in 1978 under DOE support, Santilli published monographs [2] on the foundations of the new *isomathematics* based on the axiom-preserving isotopy $A * B = A\hat{T}B$, $\hat{T} > 0$ of the universal enveloping associative algebra of quantum mechanics for the representation via the isotopic element \hat{T} of the size, shape and density of particles in deep entanglement, as occurring in nuclear structures. In the same monographs [2], Santilli developed the first known axiom-preserving isotopy of Lie's theory

with product $[A, B]^* = A * B - B * A$:

[2] R. M. Santilli, *Foundation of Theoretical Mechanics*, Springer-Verlag, Heidelberg, Germany, Volume I (1978)

<http://www.santilli-foundation.org/docs/Santilli-209.pdf>

Volume II (1981)

<http://www.santilli-foundation.org/docs/santilli-69.pdf>

While visiting the Joint Institute for Nuclear Research in Dubna, Russia, Santilli published in paper [3] of 1993 the new isonumbers and isofields with multiplicative unit $\hat{I} = 1/\hat{T} > 0$ which are at the foundation of the EPR verifications:

[3] R. M. Santilli, "Isonumbers and Genonumbers of Dimensions 1, 2, 4, 8, their Isoduals and Pseudoduals, and "Hidden Numbers," of Dimension 3, 5, 6, 7," *Algebras, Groups and Geometries* 10, 273 (1993),

<http://www.santilli-foundation.org/docs/Santilli-34.pdf>

Santilli completed in paper [4] of 1996 the construction of isomathematics with the discovery of the first known formulation of the Newton-Leibnitz differential calculus over volumes, rather than on isolated points, with applications to classical and operator mechanics:

[4] R. M. Santilli, "Nonlocal-Integral Isotopies of Differential Calculus, Mechanics and Geometries," in *Isotopies of Contemporary Mathematical Structures*, "Rendiconti Circolo Matematico Palermo, Supplem. 42, 7 (1996),

<http://www.santilli-foundation.org/docs/Santilli-37.pdf>

Jointly, Santilli published volumes [5] on hadronic mechanics for the representation of extended particles under deep mutual entanglement, as occurring in the structure of hadrons, nuclei and stars:

[5] R. M. Santilli, *Elements of Hadronic Mechanics*, Ukraine Academy of Sciences, Kiev, Volume I (1995),

<http://www.santilli-foundation.org/docs/Santilli-300.pdf>

Volume II (1994),

www.santilli-foundation.org/docs/Santilli-301.pdf

Volume III (2016),,

www.santilli-foundation.org/docs/elements-hadronic-mechanics-iii.compressed.pdf

Following the preceding preparatory research, Santilli published in paper [6] of 1998 his second verification of the EPR argument that included: the proof that Bell's inequality is *inapplicable* (rather than violated) for a system of extended, strongly interacting particles in deep mutual entanglement; proved the existence of classical counterparts under the indicated conditions; and achieved the first known exact representation of nuclear magnetic moments:

[6] R. M. Santilli, "Isorepresentation of the Lie-isotopic SU(2) Algebra with Application to Nuclear Physics and Local Realism," reprinted from *Acta Applicandae Mathematicae* 50, 177 (1998), <http://www.eprdebates.org/docs/epr-paper-i.pdf>

Santilli published in the 2019 paper [7] his *third verification of the PR argument* consisting of a Lie-isotopic generalization of Heisenberg's uncertainties for strong interactions which generalization progressively recovers Einstein's determinism with the increase of the density of the hadronic medium, and achieves full determinism at the limit of gravitational collapse:

[7] R. M. Santilli, "Studies on the classical determinism predicted by A. Einstein, B. Podolsky and N. Rosen," reprinted from *Ratio Mathematica* **37**, 5 (2019), <http://www.eprdebates.org/docs/epr-paper-ii.pdf>

Santilli published his *fourth verification of the EPR argument* in monograph [8] of 2001 on the completion of quantum chemistry into hadronic chemistry that allowed the first known *attractive* force between the *identical* electrons in valence couplings:

[8] R. M. Santilli, *Foundations of Hadronic Chemistry, with Applications to New Clean Energies and Fuels*, Kluwer Academic Publishers (2001), <http://www.santilli-foundation.org/docs/Santilli-113.pdf>
Russian translation by A. K. Aringazin, <http://i-b-r.org/docs/Santilli-Hadronic-Chemistry.pdf>

and achieved in Refs. [9] of 1998 with the chemist D. D. Shillady the first known exact representation of molecular data from unadulterated basic axioms:

[9] R. M. Santilli and D. D. Shillady, "A new isochemical model of the hydrogen molecule," *Intern. J. Hydrogen Energy* **24**, 943 (1999), <http://www.santilli-foundation.org/docs/Santilli-135.pdf>
"A new isochemical model of the water molecule," *Intern. J. Hydrogen Energy* **25**, 173 (2000), <http://www.santilli-foundation.org/docs/Santilli-39.pdf>

Santilli finally achieved in monograph [10] of 2006 his *fifth verification of the EPR argument*, this time, for the representation of antiparticles according to Paul Dirac (as having negative energy), with the first known quantitative, structural representation of particle-antiparticle annihilation into light:

[10] R. M. Santilli, *Isodual Theory of Antimatter with Applications to Antigravity, Grand Unifications and Cosmology*, Springer (2006), [www.santilli-foundation.org/Users/ruggero/Desktop/FOLDER 5 20-4-20docs/santilli-79.pdf](http://www.santilli-foundation.org/Users/ruggero/Desktop/FOLDER%204-20docs/santilli-79.pdf)

A review of the above EPR verifications and their applications in various fields is available in the 2020 papers:

[11] R.M. Santilli, "Studies on A. Einstein, B. Podolsky, and N. Rosen prediction that quantum mechanics is not a complete theory, Paper I: Basic methods," *Ratio Mathematica* **38**, 5, (2020) <http://eprdebates.org/docs/epr-review-i.pdf>
Paper II: Apparent proof of the EPR argument," *Ratio Mathematica* **38**, 71 (2020), <http://eprdebates.org/docs/epr-review-ii.pdf>
Paper III: Illustrative examples and applications," *Ratio Mathematica* **38**, 139 (2020),

<http://eprdebates.org/docs/epr-review-iii.pdf>

Tutoring lectures in the above EPR verification are available from the links:

Tutoring Lecture I: Isomathematics

<http://www.world-lecture-series.org/santilli-tutoring-i>

Tutoring Lecture II: Verifications of the EPR argument

<http://www.world-lecture-series.org/santilli-tutoring-ii>

Tutoring Lecture III: Lie-admissible formulatins

<http://www.world-lecture-series.org/santilli-tutoring-iv-part-1>

<http://www.world-lecture-series.org/santilli-tutoring-iv-part-2>

<http://www.world-lecture-series.org/santilli-tutoring-iv-part-3>

A nine minutes video in the 2020 International Teleconference in the EPR Argument is available from the link:

The legacy of Einstein for new clean energies

<http://www.world-lecture-series.org/legacy-of-einstein-for-new-clean-energies>