An Introduction to Hadronic Mechanics, Volume I

An Introduction to Hadronic Mechanics, Volume I:

Applications to Nuclear Physics

By

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Cambridge Scholars
Publishing

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This book first published 2026

Cambridge Scholars Publishing

Lady Stephenson Library, Newcastle upon Tyne, NE6 2PA, UK

British Library Cataloguing in Publication Data
A catalogue record for this book is available from the British Library

ISBN: 978-1-0364-7004-3
ISBN (Ebook): 978-1-0364-7005-0

This book is dedicated to my friend

Professor Erik Trell, M. D.
University of Linköping, Sweden

for his uniquely eclectic knowledge of
mathematics, physics, chemistry and biology

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PREFACE

Since the early 20th century, the study of physics has long been dominated by the principles of quantum mechanics including Heisenberg's uncertainty principle and Pauli exclusion principle. While these theories have provided significant insights into the behaviour of particles at the atomic level, they have also encountered limitations at deeper structural levels as first indicated by A. Einstein, B. Podolsky and N. Rosen (EPR) with their 1934 historical view that *"Quantum mechanics is not a complete theory"* [1] (Chapter 1).

By using a language accessible to the general educated audience, this book *"An Introduction to Hadronic Mechanics, Volume I: Applications to Nuclear Physics*" attempts to encapsulate the mathematical, theoretical, experimental and industrial advancements made to date in the EPR completion of quantum mechanics into a new discipline for strongly interacting particles, that I therefore called *hadronic mechanic* [3] (see also subsequent monographs [4]-[10]; collection of recent independent papers [11]; recent applications in nuclear physics [12]-[17], chemistry [18] [19] and biology [20] [21]; and recent reviews [22]-[26]).

I initiated the studies with my 1965 Ph. D. Thesis in Theoretical Physics at the University of Torino, Italy, and continued from September 1977 to August 1981 at Harvard University under DOE support and from September 1981 to date at the Institute for Basic Research, which studies have been complemented by numerous contributions from mathematicians, theoreticians and experimentalists with applications in all quantitative sciences.

The first chapters introduce fundamental concepts on the need for the EPR completion of quantum into hadronic mechanics, providing an overview of its development within a historical context. We delve into the experimental foundations supporting the theory, highlighting key evidence and observations demonstrating that the extended charge distributions of protons and neutrons are in conditions of deep mutual penetration and entanglement, resulting in the presence of contact/non-Hamiltonian interactions [2] which are outside the representational capabilities of quantum mechanics, yet represented in hadronic mechanics via the completion of all associative products AB of quantum mechanics into the associativity-preserving form A⋆B = ASB, where S is a positive-definite companion of the Hamiltonian H [3], nowadays called the Santillian [21-[25], also representing Bohm's hidden variables as being hidden in the axiom of associativity.

Despite its simplicity, the representation of non-Hamiltonian interactions with the completed product A⋆B = ASB requires, for consistency, the corresponding completion of the multiplicative unit, from the equally millenary number 1 of quantum mechanics into the positive-definite quantity $1^* = 1/S > 0$. In turn, the indicated axiom-preserving completions of the multiplicative unit and related product requires, when applicable, a corresponding compatible re-formulation of the totality of 20th century applied mathematics and related quantitative sciences with no exception known to me [25], thus explaining the decades of efforts that resulted to be needed in the achievement of maturity in the completion of quantum into hadronic mechanics.

Subsequent chapters trace the origination and evolution of hadronic mechanics, detailing my early studies and the theoretical advancements that led to the development of the new Lie-admissible and Lie-isotopic mathematics and related branches of hadronic mechanics to represent time irreversible (Lie-admissible) and reversible (Lie-isotopic) bound states of extended charge distributions/wave packets in condition of mutual penetration with potential Hamiltonian and contact non-Hamiltonian internal forces as occurring in nuclear, molecular or biological structures.

Applications and advancements in nuclear physics [12]-[17] form a crucial part of this first volume. Following the study of the new mathematical and physical methods needed for the representation of extended wave packets in condition of deep mutual entanglement, we review in Chapter 8 the achievement by hadronic mechanics of the first known numerically exact and time invariant representation of the synthesis of the neutron from a proton and an electron in the core of star, as well as the Deuteron and other stable nuclei (Sections 8.2 to 8.6). We then review the extensive tests and certifications of the excess clean energy produced by Intermediate Controlled Nuclear Fusions (ICNF) of light natural elements, (Section 8.7). We finally review the sustained and controlled synthesis of negatively charged pseudo-nuclei (hadronic bonds of electron pairs in singlet coupling and natural nuclei thanks to their extremely big Coulomb attraction) which are solely possible under the hadronic uncertainty principle [12] [24], and their natural attraction in singlet coupling by ordinary positively charged nuclei, resulting in the inevitable HyperFusions with the production of clean nuclear energy without the Coulomb barrier and without harmful radiation or waste (Section 8.8).

We then review the experimental and industrial efforts to achieve the novel HyperFusions which are sustainable nuclear fusions of light natural elements without the Coulomb barrier and without the emission of harmful radiation. (Section 9.8).

By recalling that Heisenberg's uncertainty principle is experimentally established solely for point like particles in vacuum under electromagnetic and weak interactions, particular attention is dedicated to the fact that the above advances are solely possible under the progressive weakening of Eisenberg's uncertainty principle for extended particles in deep mutual entanglement in the structure of hadrons, nuclei and stars, with the full recovering of Einstein's determinism at the Schwartzschild's horizon for black holes [12] [25] (Chapter 6).

The most important advancement by the EPR completion of quantum chemistry into *hadronic chemistry* [7] has been the first known identification of the attraction between the identical electrons of valence bonds [7] with ensuing quantitative representations of molecular structures, resulting in the first known numerically exact representation of the experimental data of the Hydrogen [18] and water molecules [19].

In a future volume, I plan to review the most important advancements achieved by the EPR completion of quantum biology into *hadronic biology* [8], such as the first known mathematical representation of life intended as the difference between organic and inorganic molecules [20] with ensuing first known quantitative representation of biological events or behavior that are generally considered to be supernatural [21] (see volumes [15] for independent contributions).

The experimental verifications and case studies presented here provide concrete evidence of the validity and applicability of hadronic mechanics. These studies affirm the theoretical constructs and illustrate their potential to address unresolved problems in physics, chemistry and biology.

Readers exposed for the first time to the new mathematics and mechanics are suggested to read first the overview presented in the Executive Summary of Sect. 9, or see my 30' lecture at the 2025 Materials 2.0, Cambridge, U. K., https://www.world-lecture-series.org/level-XVIII and then pass to the reading of preferred topics

Most of the original insights on hadronic mechanics were first published in the Hadronic Journal, which was founded for that purpose in April 1978 at Harvard University by Profs. H. Georgi and R. M. Santilli with the Editorship of numerous distinguished scholars around the world under the administration of my wife Carla Santilli as President of Hadronic Press, Inc. www.hadronicpress.com. Since that time, the Hadronic Journal has continued regular production for forty-seven years by publishing at no cost a large number of refereed papers, Ph. D. theses, proceedings of workshops, and international conferences on hadronic mechanics cited in this book for interested historians.

As we conclude, we reflect on the future directions of this evolving field. The book highlights open problems, potential advancements, and areas ripe for further research. This book is intended for scientists and students keen on exploring the frontiers of physics beyond the traditional paradigms. I hope this work will inspire further research and foster a deeper understanding of the complex interactions that govern the behaviour of matter at the most fundamental level.

I extend my deepest gratitude to all colleagues who have contributed to the development of hadronic mechanics and to my readers, who continue to seek knowledge and understanding in this ever-expanding field of study with particular reference to Professors H. Ahmar, A.O. E. Animalu, A. K. Aringazin, A. Bayoumi, S. Beghella-Bartoli, T. Bhadra Man, A. Bhalekar, R. Brenna, C. Burande, W. Cai, P. Caldirola, I. B. Das Sarma, B. Davvaz, S. S. Dhondge, J. Dunning-Davies, I. Gandzha, R. M. F. Ganfornina, S. Georgiev, T. Gill, V. de Haan, C.-X. Jiang, A. Jannussis, . E. Johansen, J. V. Kadeisvili, T. Kuliczkowski, J. Lohmus, R. Mignani, A. P. Mills, R. Miron, R. Perez-Enriquez, M. R. Molaei, A. Muktibodh, H. C. Myung, A. A. Nassikas, M. Nishioka, R. Norman, Z. Oziewicz, J. Rak, E. Recami, A. Shoeber, D. S. Sourlas, J. N. Valdez, E. Trell, B. Veljanoski, Gr. T. Tsagas, T. Vougiouklis, H. E. Wilhelm, Y. Yang, L. Ying, and others.

I would like to express my sincere thanks to: Professors N. Muktibodh from India and S. Georgiev from France for a review of the mathematical content of the book; Professors A. K. Aringazin from Kazakhstan, J. Dunning Davies from England, F. Inglese from Italy, Lessner from Israel and E. Velardo from Italy for a review of the physical content of the book; S. Beghella Bartoli from Italy and M. Kashchenko from Russia for a control

of the industrial applications of the book; Mrs. Sherri Stone, of the Hadronic Press, for a linguistic control; and my Artificial Intelligence for technical control of the book and for composing the two indeces

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October 15, 2025
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www.i-b-r.org/Sir-Santilli-bionotes-05-15-21.pdf

https://www.i-b-r.org/Ruggero-Maria-Santilli.htm

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CHAPTER 1

APPARENT INSUFFICIENCIES OF QUANTUM MECHANICS IN NUCLEAR PHYSICS

1.1. Introduction

Quantum mechanics, with its probabilistic nature and wave-particle duality, has profoundly increased our understanding of the microscopic world. Despite its successes in the exact representation of point-like particles in a vacuum under electromagnetic interactions, notable physicists, including Einstein, have questioned the completeness of quantum mechanics, arguing that it fails to represent the entirety of physical reality. By using a language accessible to the general physics audience, this chapter explores Albert Einstein's [1-1] critique of quantum mechanics, Niels Bohr's [1-2] rebuttal, and R. M. Santilli's [1-3] identification of apparent insufficiencies of quantum mechanics in nuclear physics (see also Refs. [1-4] [1-5] and vast literature quoted therein).

1.2. Einstein's Critique of Quantum Mechanics

In 1935, Albert Einstein and hid graduate students Boris Podolsky and Nathan Rosen (EPR) [1-1] published a seminal paper titled "Can Quantum-Mechanical Description of Physical Reality Be Complete?" In this paper, they argued that quantum mechanics does not entirely describe reality. They introduced the concept of "elements of reality," suggesting that if a physical quantity can be predicted with certainty without disturbing the system, it must correspond to an element of reality. According to EPR, Quantum mechanics fails to account for such elements fully.

Einstein's discomfort with quantum mechanics stemmed from its inherent indeterminism and the inability of quantum mechanical wave packets to represent the entire physical reality. He believed that quantum mechanics should eventually be supplemented by a more comprehensive theory that could restore classical determinism under some limit conditions.

The EPR paper presented a thought experiment involving two particles that interacted and separated. According to quantum mechanics, the particles become entangled, meaning the measurement of one particle's state instantaneously determines the state of the other, regardless of the distance between them. This phenomenon, which Einstein famously referred to as "spooky action at a distance," seemed to violate the principle of locality.

EPR argued that if quantum mechanics were complete, it should be possible to determine both particles' position and momentum simultaneously. The paradox they presented showed that either quantum mechanics is incomplete or requires abandoning the locality principle.

1.3. Bohr's Rebuttal

Niels Bohr, [1-2] a staunch defender of quantum mechanics, responded to the EPR paper by emphasizing the role of measurement in defining physical reality. According to Bohr's Copenhagen interpretation, quantum mechanics does not describe an objective reality independent of observation. Instead, it provides probabilities for different measurement outcomes.

Bohr argued that the EPR thought experiment did not reveal any incompleteness in quantum mechanics but instead highlighted the fundamental limitations of classical concepts when applied to quantum phenomena. He maintained that measurement disturbs the system, making it impossible to attribute definite values to physical quantities before measurement.

Bohr argued that the EPR thought experiment did not reveal any incompleteness in quantum mechanics but instead highlighted the fundamental limitations of classical concepts when applied to quantum phenomena. He maintained that measurement disturbs the system, making it impossible to attribute definite values to physical quantities before measurements.

1.4. Apparent Experimental Insufficiencies

In support of the EPR argument [1-1], Ruggero Maria Santilli [1-3] argues that non-relativistic and relativistic quantum mechanics are not complete theories, firstly, because of several apparent insufficiencies in the representation of nuclear experimental data and, secondly, because of apparent axiomatic insufficiencies for the representation of complex structures in the universe.

1.4-1. Inability to represent the synthesis of the neutron from the Hydrogen atom in the core of stars

Stars initiate their lives as an aggregate of Hydrogen and must synthesize the neutron from the Hydrogen as a condition to synthesize the Deuteron from a proton and a neutron, and finally, initiate the production of light via the synthesis of the Helium from two Deuterons. Despite the extremely large Coulomb attraction between the electron and the proton due to their opposite charges, quantum mechanics cannot represent the synthesis of the neutron from a proton and an electron because prohibited by Heisenberg's uncertainty principle since the standard deviation of the coordinates of the electron is a large multiple of the size of the neutron. The standard deviation of its linear momentum implies the electron energy is a multiple of the neutron's. Additionally, the synthesis of the neutron from a proton and an electron requires energy because the mass of the neutron is 0.782 MeV *bigger* than the sum of the masses of the proton and of the electron, thus requiring a "mass excess," which is anathema for quantum mechanics due to its sole possibility of representing the known "mass defect" in nuclear fusions. (Sect. 2.3, p. 47 of [1-3]).

1.4-2. Inability to achieve an exact representation of nuclear magnetic moments

The quantum mechanical computation of the magnetic moment of the smallest possible atom, the Deuteron, from those of the nuclear constituents, the proton and the neutron, is about 3% off the experimental value, with deviations for heavier nuclei, such as the Zirconium, so large to prevent a scientific analysis (Sect. 2.6, p. 50 of [1-3] and Fig. 1.1).

1.4-3. Inability to achieve a consistent representation of nuclear spins

The sole stable bound state predicted by quantum mechanics for spinning particles is that they couple with opposite spins. In contrast, the coupling with parallel spins is highly unstable, as for ordinary gears. The application of the above basic law to the spin of the Deuteron is that the proton and the neutron should couple with opposite spins, in which case the total angular momentum of the Deuteron is zero in gross disagreement with experimental measurements for which said spin is one. When facing such an inconsistency, mainstream nuclear physicists claim that the total value one is due to orbital contributions, which is, again, in gross disagreement with experiments since the total spin one is measured for the Deuteron in its ground state, which by definition, is the state with null orbital contributions. In passing to the spin of heavier nuclei, the deviations between quantum mechanical predictions and the experimental values of nuclear spins are too large to prevent a scientific analysis (Sect. 2.5, p. 49 of [1-3] and Fig. 1.2).

1.4-4. Inability to represent nuclear stability despite the neutron's natural instability

Following its synthesis from a proton and an electron, the neutron is naturally unstable since it decays spontaneously into its original constituents in about 15 minutes. However, all organic and inorganic matter in our environment contains stable nuclei that, according to mainstream nuclear physicists, are composed of protons and neutrons. This visual evidence implies the transition of the neutron from an unstable state in a vacuum to a permanently stable state in a nuclear structure, which is prohibited by the special relativity of relativistic quantum mechanics, technically, by the invariance of masses under the fundamental Poincare' symmetry (Sect. 2.4, p. 59 of [1-3]).

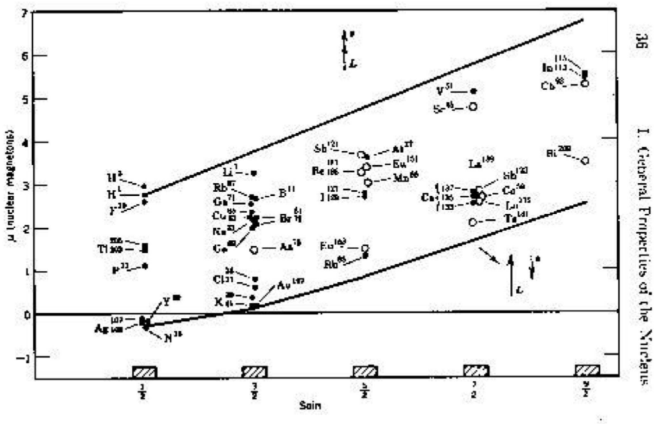

Figure 1.1. A historical insufficiency of quantum mechanics in nuclear physics is the inability to achieve in one century an exact representation of nuclear magnetic moments, with 3% deviations for the Deuteron and embarrassing deviations for heavy nuclei reported in this figure.

1.4-5. Inability to represent nuclear stability despite the strongly repulsive protonic Coulomb force

Neutrons have no electric charge, while protons are positively charged. Consequently, the protons of permanently stable nuclei in our environment experience a repulsive Coulomb force which, according to simple calculations, is of the order of thousands of Newtons, thus being so astronomical in value for nuclear standards that available quantum mechanical models of nuclear forces cannot overcome. It follows that, after one century of research, quantum mechanics has been unable to represent nuclear stability (Sect. 2.4, p. 59 of [1-3]).

1.4-6. Inability to predict industrially viable recycling of radioactive nuclear waste

In Santilli's view, one of the potential historical problems of our decaying environment is that quantum mechanics has been unable to predict, let alone develop, any industrially viable means for the recycling of radioactive nuclear waste, that consequently, had to be stored by nuclear power plants in their facilities since the beginning of their operations up to the current alarming storage levels. Given the known opposition against the transportation of waste in public roads, the only industrially effective means is recycling radioactive nuclear waste by the nuclear power plants themselves in their own facilities. In turn, such recycling can only be done via nuclear transmutations of very long into very short mean lives that non-relativistic and relativistic quantum mechanics strictly prohibit. [1-3]

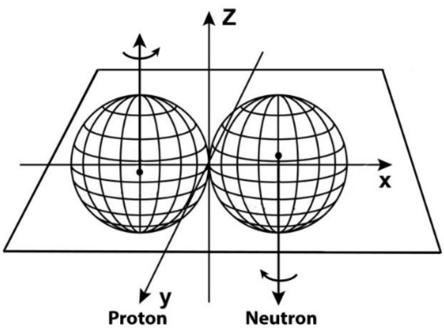

Figure 1.2. Quantum mechanics cannot represent the spin S = 1 of the Deuteron because the sole possible stable bound state between a proton and a neutron both with spin 1/2 is the singlet with spin S = 0 depicted in this figure, by therefore

requiring the century old, hypothetical assumption of orbital states with angular momentum L = 1 against the measurement of the Deuteron spin S = 1 in its ground state. Greater departures between quantum mechanical predictions and experimental evidence occur for the spin of heavier nuclei.

1.4-7. Inability to represent controlled and sustainable clean nuclear fusions

In Santilli's view, the biggest, potentially historical reason for the alarming decay of our environment is the century-old inability of non-relativistic and relativistic quantum mechanics to achieve sustainable nuclear fusions. A first reason for this insufficiency is the known inability by quantum mechanics to represent the irreversibility of nuclear fusions due to its strictly conservative axiomatic structure. A second reason is the inability to bypass the Coulomb barrier, i.e., the repulsive Coulomb force between natural, positively charged nuclei, which has to be overcome to achieve nuclear contact. Nuclear fusions are unavoidable at this point due to the activation of the strongly attractive nuclear force. The potentially historical character of these insufficiencies is the vastly ignored evidence that the repulsive force of the Coulomb barrier has such an astronomical value indicated earlier to prevent a plausible overcome by mechanical, magnetic, and other conventional means, while much needed. Heisenberg's uncertainty principle generally prohibits new approaches.

1.5. Apparent axiomatic insufficiencies

Santilli continues the analysis in paper [1-3] by identifying the apparent axiomatic origin of insufficiencies 1.4-1 to 1.4-7, whose solution is attempted in Chapter 3 for possible completion of quantum mechanics according to the EPR argument [1-1].

1.5-1. Locality

Non-relativistic and relativistic quantum mechanics, including their Galilean and Lorentz symmetries and ensuing relativities, are local theories [1-1] because they can solely be defined at one point in space. Such an axiomatic structure has been experimentally proved valid for point-like particles in a vacuum under long-range electromagnetic and other interactions. This is true for atomic electrons, particles in accelerators, crystals, and others. However, the same locality is expected to be insufficient for nuclear structures, complex chemical compounds, and numerous other cases in the universe in which we have extended constituents in conditions of mutual penetration, resulting in basically new contact, thus zero-range interactions that are extended over volumes not reducible to a finite set of isolated points, thus requiring a non-local completion of quantum mechanics. Santilli argues that the mathematically, physically, and chemically consistent treatment of dimensionless particles requires local theories. However, the representation of the physical or chemical reality of the extended character of particles implies, per se, the inapplicability (rather than the violation) of local theories in favor of their non-local completion [1-1] under the condition of unambiguously recovering conventional local theories for mutual distances sufficiently large to permit the point-like abstraction of physical particles (Sect. 3.2, p. 53 of [1-3]).

1.5-2. Linearity

The dynamical equations of quantum mechanics, such as Schroedinger's equation, are linear in the sense of depending on the first power of the wave function. However, there are several technical arguments, e.g., to represent the entanglement of particles, suggesting the need for the non-linear completion of linear theories [1-1], i.e., theories with dynamical equations depending on arbitrary powers of the wave function as a condition to represent broader physical realities (Sect. 3.1, p. 52 of [1-3]).

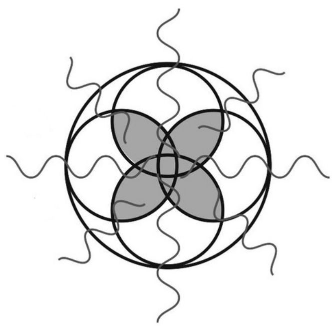

Figure 1.3. According to half a century of measurements, the charge distribution of the proton and the neutron has the radius $R = 0.87 \times 10^{-13}$ cm while the charge distribution of the Helium has the radius $R = 1.6 \times 10^{-13}$ cm. Consequently, the two protons and the two neutrons in the Helium structure are in condition of partial mutual penetration of their hyperdense structures for 0.07 \times 10^{-13} cm, with ensuing non-linear, non-local and non-potential interactions beyond any hope of representation via quantum mechanics.

1.5-3. Potentiality

The abstraction of particles as being point-like automatically restricts all possible interactions to be derivable from a potential. By contrast, the representation of the actual physical dimension of particles leaves unchanged potential interactions due to their long-range character yet requires their completion with contact zero-range interactions that, as such, are not derivable from a potential. Santilli's main argument outlined in this book is that a most important completion of quantum mechanics according to the EPR argument [1-1] appears to be that with a mathematically, physically, and chemically consistent representation of non-potential interactions since they automatically imply the quantitative representation of the extended character of particles and their non-local and non-linear interactions (Sect. 3.3, p. 54 of [1-3]).

1.5-4. Time reversibility

In Santilli's [1-3] view, the most serious limitation of quantum mechanics that has prevented to date significant solutions to our decaying environment is its time reversibility, here referred to the invariance of the dynamical equations under time reversal technically expressed as the invariance of the Schroedinger's and Heisenberg's equations under anti-Hermiticity. Time reversal invariance is effective and necessary for the consistent representation of stable structures with point-like constituents, such as atomic structures. However, due to their known time irreversibility, the same invariance is grossly insufficient for the representation of any physical or chemical energy releasing process, such as nuclear fusions or fuel combustions. Moreover, recent studies in this book have shown that the EPR completion of quantum mechanics into a time-irreversible theory directly impacts the engineering realization of energy-releasing processes. In conclusion, a time-irreversible non-potential completion of quantum mechanics for extended constituents appears to be most promising for energy-releasing processes, while admitting as a particular case a time-reversible and non-potential completion for the representation of stable structures with extended constituents (Sect. 2.7, p. 51 of [1-3]).

1.5-5 One-side modular structure

From a mathematical viewpoint, the Schroedinger representation of quantum mechanics has a right modular structure in the sense of being characterized by the multiplication ordered to the right of a Hamiltonian

H(r, p) to a state $|\psi(r)>$ of a Hilbert space, resulting in the familiar eigenvalue equations $H(r, p)\ |\psi(r)> = E\ |\psi(r)>$, while ignoring the corresponding left modular action $<\psi(r)|\ E = <\psi(r)|\ H(r, p)$ because trivially implied by the right action for stable systems of point-like constituents. As we shall see in Chapter 3, the relaxation of the above structure and the use of a full, right, and left bi-modular structure offers realistic possibilities for an axiomatic representation of time irreversibility for energy-producing processes with extended constituents (Sect. 3.4, p. 55 of [1-3]).

1.5-6. Single valuedness

Quantum mechanics has a single-valued structure in that all multiplications yield one result irrespective of the multiplication order. For instance, the product of the number 2 by 3 yields the single result 6 irrespective of whether 2 multiplies 3 to the right or 3 multiplies 2 to the left, and the same holds for all other quantum mechanical multiplications. In Santilli's view, the indicated single valuedness is sufficient for contemporary physical and chemical studies but grossly insufficient for the study of biological structures since the correlation/entanglement of two atoms in a DNA, mathematically representable with a product, may yield a complete organ with 10^{30} atoms. This occurrence suggests the need for biological structures of the most complex mathematics conceivable by the human mind, such as the time-irreversible hyperstructures whose product yields an unlimited number of ordered results (Sect. 3.5, p. 55 of [1-3]).

1.5-7. Positive energies

According to 20th century relativistic quantum mechanics, all particles identified to date, including antiparticles, have positive masses to prevent a violation of special relativity. However, as we shall see in Chapter 13, the demolition into the light of a pair of particles and its antiparticle both having positive energy is prohibited by the axioms of the theory, therefore supporting Paul Dirac's 1928 conception of antiparticles as having negative energies under the use of an appropriate mathematics expected to be based on a negative unit as a condition to prevent causality problems.

1.6 Santilli's rebuttal of Bohr's objections

A theory should be considered complete for given physical conditions when it provides an exact and time invariant representation of the physical reality characterized by measured experimental data. Quantum mechanics provides an exact and invariant representation of the experimental data for the hydrogen atom, accelerator particles, crystals, and other systems of point-like particles in a vacuum. Still, it cannot be considered a complete theory because it does not provide an exact and invariant representation of experimental data of nuclear physics 1.4-1 to 1.4-1-7, besides being disproved by widely ignored experimental evidence in virtually all fields of physics, such as * see the recent general review by E. Velardo [1-21]):

1.6-1) Three direct experimental verifications of the EPR argument that quantum mechanics is not a complete theory [1-6] [1-7] [1-8].

1.6-2) Experimental evidence [1-9] [1-10] on the lack of exact character of quantum electrodynamics for the muon data, and their sole known exact and invariant representation via hadronic mechanics [1-11] [1-12].

1.6-3) Experimental violation of quantum mechanics in the behavior of the mean life of the K-mesons with speed and its sole exact and invariant representation via hadronic mechanics [1-13]-[1-15].

1.6-4) Exact and invariant representation by hadronic mechanics of the shape and density of the proton-antiproton fireball in the Bose-Einstein correlation [1-16] [1-17] in lieu of the four completely arbitrary chaoticity parameters of quantum formulations.

1.6-5) Experimental confirmation in the USA and in Europe of the local character of the speed and frequency of light propagating within physical media [1-18], experimental confirmation on Earth of Zwicky's Tired Light [1-20] [1-21], with ensuing removal of Earth at the center of the universe which is inherent in the expansion of the universe due to the validity of Hubble's law on the cosmological redshift in all radial directions from Earth (www.eprdebates.org/no-universe-expansion.php).

References of Chapter 1

[1] Einstein, A., Podolsky, B. and Rosen, N.: Can quantum-mechanical description of physical reality be considered complete?, *Phys. Rev* 47, 777-70 (1935), http://www.eprdebates.org/docs/epr-argument.pdf

[2] Bohr, N.: Can Quantum-Mechanical Description of Physical Reality Be Considered Complete? *Physical Review* 48, 696-702 (1935), https://santilli-foundation.org/docs/santilli-532.pdf