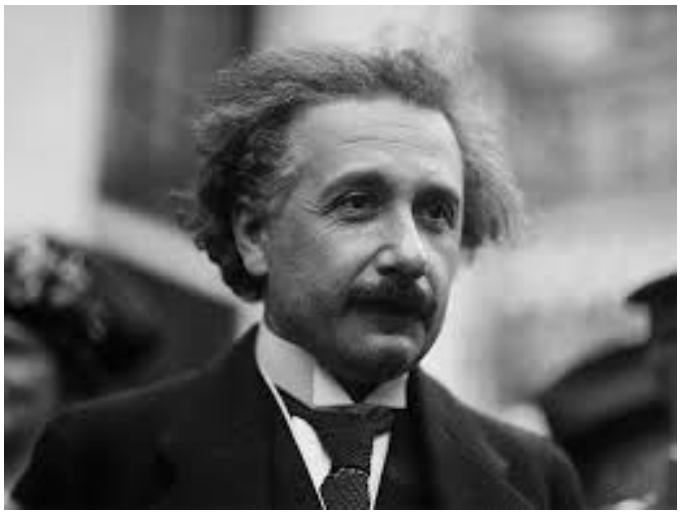

Figure 1: *"God does not play dice with the universe, " Albert Einstein*

Confidential proposal for the organization of a workshop in August 2020

Draft date December 19, 2019

INTERNATIONAL WORKSHOP ON EINSTEIN DETERMINISM

Mathematical, physical and chemical studies on the 1935 prediction by A. Einstein, B. Podolsky and N. Rosen that "quantum mechanics is not a complete theory." and that there could exist conditions in the universe recovering classical determinism (EPR Argument).

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ORGANIZER:
The R. M. Santilli Foundation
Web site: http:

www.santilli-foundation.org/
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SCOPE OF THE WORKSHOP:
Appraise, develop and apply recent apparent proofs of the EPR argument, Refs. [9] [10] and contributions quoted therein, (see Refs. [11] to [40] for general reviews).

FINANCIAL SUPPORT:
The RMS Foundation shall cover all costs for the rental of the workshop room, lunch, and travel-hotel costs for invited speakers. Donations are welcome for the support of additional speakers and graduate students.

LANGUAGE :
Inauguration Speeches should be delivered in the language of the hosting country. All technical talks and discussions shall be entirely in English.

SUGGESTED DATE:
January 4 to 8, 2021

SESSIONS:

Day 1: 10 am to 12 noon: Inaugural Speeches

Day 1: 2 pm to 6 pm: Session in Mathematics
Prof. S. Georgiev, Chairman

Day 2: Session in Physics
Prof. R. M. Santilli, Chaiurman

Day 3: 9 am to 12 noon, Session in Chemistry,
Prof. A. A. Bhalekar, Chairman

Day 3: 2 pm to6 pm: Open Discussions.

noindent Day 3, 7 pm: Banquet.

LECTURES:
Mandatory discussions are scheduled at the end of each lecture. Hence, the duration of all lectures will be restricted to 50 minutes, so as to have 10 minutes for discussions.

DIRECT PARTICIPATION:
Participation to the inauguration speeches is open to all. Scientists and graduate students interested in participating to the technical sessions are requested to apply to the RMS Foundation with a one page summary of the proposed talk/participation and a copy of the CV.

REMOTE PARTICIPATION Remote viewing of the lectures as webinars will be male available to interested colleagues.

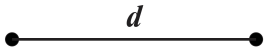

Figure 2: *In this figure, we present a conceptual rendering of the tacit assumption underlying the objections against the EPR argument [2] - [6], namely, the representation of particles as being point-like because it is solely possible under the differential calculus underlying quantum mechanics, namely, the representation of particles as isolated points in empty space. A first consequence is that, being dimensionless, particles can only be at a distance, with ensuing Einstein's argument on the need for superluminal interactions to explain quantum entanglement [1]. A second consequence is that, being at a distance, the sole possible interactions are of linear, local and potential type, under which assumptions the objections against the EPR argument are indeed valid.*

INTERNET DEBATES:
Anonymous comments or questions can be place in the **EPR Debate in Physics**
http://eprdebates.org/santilli-confirmation-of-the-epr-argument.php
or in the **EPR debate in Chemistry**
http://eprdebates.org/santilli-confirmation-of-the-epr-argument-chemistry.php

PROCEEDINGS:
It is important to have a record of the conference. Funding is subject to each speaker writing a paper for publication at no cost in *Algebras, Groups and Geometries* (35 years of regular publication) or in the *Hadronic Journal* (42 years of regular publications). All papers will be subsequently collected and published as a single volume of proceedings.

IINTRODUCTORY SCIENTIFIC INFORMATION:

1.1. The EPR argument

As it is well known, Albert Einstein did not accept quantum mechanical uncertainties as being final, for which reason he made his famous quote "God does not play dice with the universe."

More particularly, Einstein believed that "quantum mechanics is not a complete theory," in the sense that it could be broadened into such a form to recover classical determinism at least under limit conditions.

Einstein communicated his views to B. Podolsky and N. Rosen and they jointly published in 1935 the historical paper [1] that became known as the *EPR argument.*

In view of the rather widespread belief that quantum mechanics is a final theory valid for all conceivable conditions existing in the universe, objections against the EPR argument has been voiced by numerous scholars, including by N. Bohr [2], J. S. Bell [3] [4], J. von Neumann [5], and others (see Ref. [6] for a review and comprehensive literature). The field became known as *local realism* and included the dismissal of the EPR argument based on claims that quantum axioms do not admit *hidden variables* λ [7] [8].

1.2. Basic assumptions.

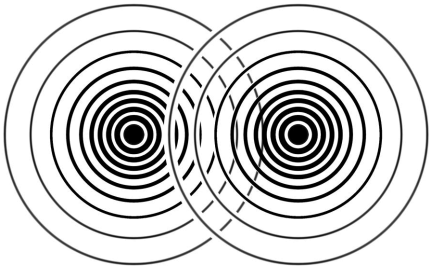

Figure 3: *A conceptual rendering of the main assumption of the apparent proofs [9] [10] of the EPR argument [1], consisting in the representation of particles as extended, deformable and hyperdense in conditions of mutual overlapping/entanglement with ensuing continuous contact at a distance eliminating the need for superluminal interactions to explain quantum entanglement. A first implication is the need, for consistency, of generalizing Newton-Leibnitz differential calculus from ts historical form solely definable on isolated points, tp a covering form definable on volumes [***?***]. Another implication is the emergence of contact, non-linear, non-local and non-potential interactions that, being not representable by Hamiltonians, require a structural lifting of the Lie-algebra structure of quantum mechanics under which the objections against the EPR argument are inapplicable (Section 3). Intriguingly, the "completions" here considered turned out to be of isotopic/axiom-preserving type, thus being fully admitted by quantum mechanical axioms, merely subjected to a realization broader than that of the Copenhagen school. The apparent proofs of the EPR argument [9] [10] become an unavoidable consequence of the indicated "completions."*

The most important aspects underlying the studies here considered are:

1) Assumption of the validity of quantum mechanics for point-like particles in vacuum with ensuing linear, local and action-at-a-distance/potential interactions (*exterior dynamical problems*) occurring in atomic structures, particles in accelerators, crystals and numerous other systems (Figure 1);

2) Study of the "completion" of quantum mechanics into hadronic mechanics for the representation of extended, therefore deformable and hyperdense particles within physical media with ensuing, additional, non-linear, non-local an d contact/non-potential interactions (*interior dynamical problems*), expected in the structure of hadrons, nuclei and stars, with limit conditions expected in the interior of gravitational collapse where the inapplicability (rather than the violation) of quantum mechanics is already accepted by the majority of serious scholars (Figure 2).

The central assumption of these studies is the axiom-preserving lifting of the conventional associative product $ab = a \times b$ between *all* possible quantum mechanical quantities (numbers, functions,. matrices, etc.) into the *isoproduct* [13] [17]

$$a \star b = a\, \hat{T}\, b, \tag{1}$$

where $\hat{T}$, called the *isotopic element,* is restricted to be positive-definite, $\hat{T} > 0$, but otherwise possesses an unrestricted functional dependence on all needed local variables.

Refs. [13] [17] constructed an axiom-preserving isotopy of the various branches of Lie's theory, resulting in a theory today known as the *Lie-Santilli isotheory* [33] with isotopic lifting of Lie algebras of the type [9]

$$[X_i \hat{,} X_j] = X_i \star X_j - X_j \star X_i = C_{ij}^k X_k.\ \ i, j = 1, 2, ..., N. \tag{2}$$

Following laborious efforts for the achievement of mathematical maturity, Ref. [9] applied the Lie-Santilli isotheory to the isotopy $\hat{SU}(2)$ of the $SU(2)$ spin symmetry with three-dimensional isoalgebras of type (2) and introduced the realization of hidden variables [7] [8] of the type

$$\hat{T} = Diag.(1/\lambda, \lambda), \quad Det\hat{T} = 1, \tag{3}$$

Therefore, Ref. [9]establishes that, contrary to objections [2] to [6], *the abstract axioms of quantum mechanics do indeed admit explicit and concrete realizations of hidden variables.*

The proof in Ref. [9] that interior systems admit identical classical counterparts was then consequential.

Isoproduct (1) also allows a direct and immediate representation of extended particles in conditions of mutual penetration entanglement with realizations of the type [26]

$$\begin{aligned} \hat{T} = \Pi_{k=1,...,N} Diag.(\tfrac{1}{n_{1k}^2}, \tfrac{1}{n_{2k}^2}, \tfrac{1}{n_{3k}^2}, \tfrac{1}{n_{4k}^2}) e^{-\Gamma}, \\ k = 1, 2, ..., N, \quad \mu = 1, 2, 3, 4. \end{aligned} \tag{4}$$

where n_1^2, n_2^2, n_3^2, (called *characteristic quantities*) represent the deformable semi-axes of the particle normalized to the values $n_k^2 = 1, `k = 1, 2, 3$ for the sphere; n_4^2 represents the *density* of the particle considered normalized to the value $n_4 = 1$ for the vacuum; and Γ represents non-linear, non-local and non-Hamiltonian interactions caused by mutual penetrations/entanglement of particles.

The smaller than 1 absolute value of the isotopic element $\hat{T}$ occurring in all known applications [17]-[29]

$$| \hat{T} | \ \leq \ 1, \tag{5}$$

permitted Ref. [10] to show that *the standard deviations Δr and Δp appear to progressively tend to zero with the increase of the density of the medium, and appear to achieve full classical determinism in the interior of gravitational collapse as conceived by Einstein.*

The initial construction of the isotopies of 20th century applied mathematics with isoproduct (1) defined over conventional numeric fields $F(n, \times, 1)$ [17] turned out to be inconsistent because the underlying time evolution is *non-unitary,* thus causing the lack of invariance over time of the traditional basic unit 1, with ensuing inapplicability over time of the entire field $F(n, \times, 1)$.

The above occurrence mandated the construction of *isofields* $\hat{F}(\hat{n}, \star, \hat{I})$ [14] [36] with basic *isounit*

$$\hat{I} = 1/\hat{T} > 0, \tag{6}$$

and *isonumbers* $\hat{n} = n\hat{I}$ equipped with isoproduct (1).

Ref. [14] essentially established that *the abstract axioms of a numeric field do not require that the multiplicative unit of the field be the trivial number 1, since said unit can be an arbitrary quantity with an unrestricted functional dependence on local variables, provided that said multiplicative unit is positive definite and the field is lifted into a compatible form.*

Despite all the above efforts, the ensuing isomathematics was still inapplicable to the proof of the EPR argument because it lacked the crucial *invariance over time,* namely, the prediction of the same interior dynamical systems under the same conditions but at different times.

The above occurrence forced the "completion" of the Newton-Leibnitz differential calculus into the covering $isodifferential\ isocalculus$ [15] [39] with basic $isodifferential$ [?]

$$\hat{d}\hat{r} = \hat{T}d[r\hat{I}(r,...)] = dr + r\hat{T}d\hat{I}(r,...), \tag{7}$$

and corresponding $isoderivative$

$$\frac{\hat{\partial}\hat{f}(\hat{r})}{\hat{\partial}\hat{r}} = \hat{I}\frac{\partial\hat{f}(\hat{r})}{\partial\hat{r}}. \tag{8}$$

In essence, Ref. [15] established the inapplicability of the conventional differential calculus whenever the axioms of numeric fields admit multiplicative units with a dependence on the differentiation variable, with ensuing inapplicability of quantum mechanics, as well as of the objections against he EPR argument, for interior dynamical systems.

The "completion" of the differential calculus into an isotopic form compatible with basic isoproduct (1) finally allowed the achievement of invariance over time, by permitting the apparent proof that extended particles immersed progressively approach classical determinism when immersed within hadrons, nuclei and stars and achieve full classical determinism aty the limit of gravitational collapse [10].

1.3. Terminology.

A few comments on terminologies appear to be recommendable.

The word "completion" is used in these studies to honor the memory of Albert Einstein and should not be intended to indicate "final" theories. In fact isomathematics and isomechanics admit coverings of Lie-admissible character [13] that, in turn, admits coverings of hyperstructural character [38], with additional coverings remaining possible in due timer.

The terms "non-Hamiltonian interactions" are intended to indicate interactions that are not representable with a Hamiltonian, and are technically identified as interactions violating the integrability conditions for the existence of a Hamiltonian, namely, the $conditions\ of\ variational\ self\text{-}adjointness$ [16].

When dealing with stable and isolated interior dynamical systems, the terms "non-conservative forces" are strictly referred to $internal$ non-Hamiltonian exchanges verifying the conditions for the validity of the ten conventional total conservation laws for the total energy, momentum, angular momentum, and the uniform motion of the center of mass.

The terms "physical media" refer to media composed by matter in its various states, and, when hyperdense, are often referred to as $hadronic\ media$ to indicate the need for hadronic mathematics and mechanics for their quantitative treatment.

The terms "extended particles" refer to: the wavepacket of elementary particles such as the electron assumed to be of about $1\ fm = 10^{-15}\ cm$; extended charge distributions for protons and neutrons when members of a nuclear structure, also assumed to have a diameter of about $1\ fm$; and stable nuclei when considering the structure of stars. Due to its crucial significance for the structure of interior systems, a technical definition of the notion of "extended particles" is given by the notion of $isoparticle$ as isorepresentations of space-time isosymmetries [12].

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