Santilli Lie-isotopic theory and its isodual

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Abstract.

This review lecture is devoted to foundations of Santilli Lie-isotopic theory and genomathematics.

Far-reaching pioneering discoveries of Santilli Lie-isotopic theory and genomathematics extend significantly the scope and applicability of Lie analysis, algebra and operator methods, opening new areas of applications leading to essential advances and broadening the scope of models in Cosmology, Physics, Chemistry and in development of new cleaner energy technologies. These new universal mathematical and especially algebraic and operator structures and methods become increasingly important in all branches and levels of modern physics from experiments to fundamental research.

In a series of works, R. M. Santilli has presented rather diversified conceptual, theoretical and experimental elements suggesting a reinspection of the validity of special relativity for interior dynamical problems at large, and the scattering region in particular. The central problem mathematically is in the development of appropriate isoscattering theory which would include the construction of a covering of the Minkowskian geometry, the Lorentz-Poincaré symmetry and special relativity into forms more effective for interior conditions. In his No Reduction Theorems, Santilli rigourously established the impossibility of a consistent reduction of interior to exterior conditions (see [23] and references there). Thus one has to investigate systems that are generally nonlinear in the wave function, nonlocal of integral character, and noncanonical or nonunitary in their time evolution, which requires development of fundamentally new mathematical concepts and tools.

Lie's theory plays fundamental role in Mathematics and Physics. Santilli identified several important limitations of the conventional Lie theory for the treatment of systems beyond the local-differential, Hamiltonian and canonical-unitary conditions. Furthermore, Santilli made a fundamental proposal that this requires new fundamental generalizations of key structures and concepts of mathematics. The new fundamental mathematical structures and notions, introduced by Santilli under names of iso-, geno- and hyper-mathematics, are motivated by the need of generalized, Hermitian, non-Hermitian and multi-valued units, respectively. The resulting iso-, geno- and hyper-Lie theories based on

the new mathematics have been extensively used for the description of nonlocal-integral systems with action-at-a-distance Hamiltonian and short-range-contact non-Hamiltonian interactions in reversible, irreversible and multi-valued conditions, respectively. Motivated by another physics observation that the conventional, iso-, geno- and hyper-Lie theories are unable to provide a consistent classical representation of antimatter yielding the correct charge conjugate states at the operator counterpart, Santilli outlined also another novel mathematics under the names of isodual conventional, iso-, geno- and hyper-mathematics, which constitute anti-isomorphic images of the original mathematics characterized by negative-definite units and norms.

This review lecture is based on the following publications.

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