SEMPARIS – Séminaires en région parisienne

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TBA

Vendredi 10 Mai 2024, 10 :30
IHES, Amphithéâtre Léon Motchane
Domaines : math

Titre : *Quantitative Hydrodynamic Limit for Interacting Particle Systems : Panorama and Recent Advances (3/4)*

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Résumé : *The course is based on a minibook that will be published by Springer. The text below is a shortened preface to this book. In the conventional exposition of quantum mechanics, we work in Hilbert space and examine operators within this space. Self-adjoint operators are associated with physical quantities. Physicists predominantly use this methodology, however, it has its limitations. In this course we explore alternative viewpoints ; our exposition does not depend on standard textbooks. We consider the algebraic approach, where the initial point is an algebra of observables, an associative algebra with involution, in which the self-adjoint elements are observables. This approach is nearly as old as quantum mechanics itself. In addition, we discuss the geometric approach, where the initial point is a set of states. This viewpoint was advocated in my recent papers ; it is much more general. We demonstrate within the framework of this approach that quantum mechanics can be viewed as classical mechanics where our devices permit us to observe only a subset of physical quantities. Furthermore, we show that using this approach we can construct a wide class of physical theories that generalize quantum mechanics. We highlight that the emergence of probabilities in quantum theory can be derived from decoherence caused by adiabatic interaction with a random environment. We underscore that the concept of a particle is not primary in quantum theory. If the theory is translation-invariant we define particles as elementary excitations of the ground state. Quasiparticles are elementary excitations of any translation-invariant state. We analyze the concept of scattering but we do not utilize the concept of a field and do not assume locality and Poincare invariance. We discuss not only the conventional scattering matrix (related to scattering cross-sections)* *but also the concept of an inclusive scattering matrix, which is closely related to the concept of inclusive scattering cross-sections. Scattering matrix can be expressed in terms of Green's functions by the well-known formula belonging to Lehmann, Symanczyk, and Zimmermann, and the inclusive scattering matrix can be expressed in terms of generalized Green's functions, which first appeared in nonequilibrium statistical physics in Keldysh formalism. As a concrete realization of the geometric approach, we describe the formalism of L-functionals where states are represented by non-linear functionals corresponding to positive functionals on Weyl and Clifford algebras (to states in the algebraic approach). L-functionals can be applied to solve the infrared problem in quantum electrodynamics.*