



istanbul matematiksel bilimler merkezi
istanbul center for mathematical sciences

MATHEMATICAL AND THEORETICAL PHYSICS AFTERNOONS

Tuesday, December 12, 2017

13:30 - 14:30: Ali Mostafazadeh (Koç Universtiy, İstanbul, Turkey)

A Geometric Extension of Quantum Mechanics

The search for a geometric generalization of Quantum Mechanics (QM) is usually motivated by the desire to formulate a consistent physical theory that would reduce to quantum mechanics and general relativity in different limits. There have been various attempts to generalize QM during the past 70 or so years, but it would be fair to say that no major progress could be made. The route of the difficulty of this problem lies in the stringent and inflexible nature of the axioms of QM and the lack of experimental guidance towards their possible alternatives. In this talk I will propose a moderate geometric extension of QM that arises as a natural reaction to a simple no-go theorem for quantum systems with dynamical state spaces, and elucidates the notion of “energy observable” for systems with a time-dependent Hamiltonian operator. In the proposed theory, the role of the Hilbert space and the Hamiltonian operator is played by a complex Hermitian vector bundle E endowed with a metric-compatible connection and a global section of a real vector bundle determined by E . The axioms of QM are not replaced by others but elevated to the level of the relevant bundles. The talk will involve a rather extensive introductory part in which the basic structure of QM as well as the necessary mathematical tools will be reviewed. It will then focus on the conceptual aspects of the subject and their consequences.

14:30 - 15:00: *Coffee Break*

15:00 - 16:00: **Dmitri Bykov** (Max Planck Institute for Gravitational Physics, Potsdam, Germany)

Complex structures and integrable sigma-models

I will introduce a class of classically integrable two-dimensional sigma-models with non-symmetric target spaces (flag manifolds). Some explicit solutions of the models will be constructed, and I will discuss the relation of these models to other integrable models that have recently appeared in the literature (eta-deformations, etc.).

Place: IMBM Seminar Room, Boğaziçi University South Campus