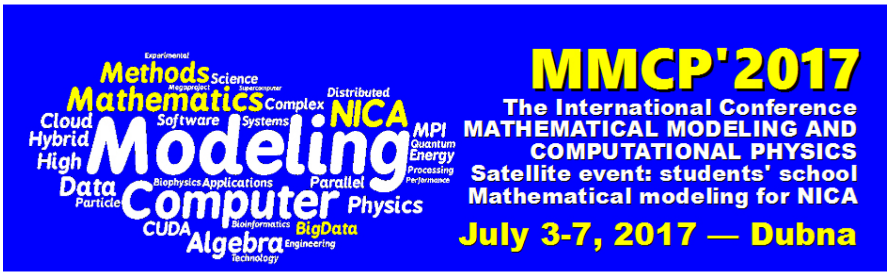

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Modeling Quantum Behavior in the Framework of Permutation Groups

Thursday, 6 July 2017 09:30 (30 minutes)

The trajectory of a quantum system is a sequence of unitary evolutions of vectors in a Hilbert space, interspersed with observations — projections of the vectors in some subspaces, that are specified by measuring devices. The result of quantum observation is random and its statistics is described by a probability measure defined on subspaces of the Hilbert space. Gleason’s theorem gives a general construction of all possible probability measures on subspaces of a Hilbert space. In fact, this construction reproduces the Born rule for quantum probabilities. Quantum-mechanical description can be made constructive, if we replace the general group of unitary transformations of the Hilbert space by unitary representations of finite groups. It is known that any linear representation of a finite group can be realized as a subrepresentation of some permutation representation. Thus, quantum mechanical problems can be formulated in terms of groups of permutations. Such a constructive approach allows us to clarify the meaning of a number of physical concepts. Combining methods of computational group theory with Monte Carlo simulation we study models based on the natural and standard representations of symmetric groups.

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