Time Flow in Interacting Many Body Systems

Rudolf Hilfer

University of Stuttgart, Germany
hilfer@icp.uni-stuttgart.de

Session: 8. Dynamic Systems with Fractional and Time Scale Derivatives

The time evolution for closed quantum many body systems is usually given as a one-parameter group of unitary operators on a Hilbert space representing a group of automorphisms on an underlying C^* -algebra of observables. Dissipative processes, irreversible phenomena, decay of unstable particles, approach to thermodynamic equilibrium or quantum measurement processes are difficult to accommodate within this framework. For infinite systems the characterization of completeness or incompleteness of this dynamical prescription is poorly understood and constitutes a nontrivial first step in the analysis of the dynamics of such systems. The time evolution of macroscopic states (or mixtures) for classical and quantum many body systems in statistical physics need not correspond to a translation group or semigroup. Instead convolution semigroups appears generically. The presentation will discuss the implications of this result for the foundations of nonequilibrium statistical physics as well as possible applications to experiment.