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MATHEMATIKKOLLOQUIUM

Das Institut für Mathematik lädt zu folgendem Vortrag ein:

Andrew Daley

Institut für Theoretische Physik, Universität Innsbruck

Classical simulation of quantum many-body systems in 1D

Quantum mechanical systems involving the dynamics of many particles with strong interactions are of great interest to physicists, both in the context of solid state systems (e.g., in describing the properties of superconductors), and in the context of recent experiments with cold atoms. These systems are described by a Hamiltonian operator acting on a Hilbert space that defines the state space of the corresponding system. However, the corresponding models are typically very difficult to solve analytically, and mean-field theories (as are used, e.g., to generate the Gross-Pitaevskii equation that describes the Physics of a dilute Bose-Einstein condensate) are often not applicable. They are also extremely difficult to simulate numerically, as the dimension of the Hilbert space grows exponentially with the size of the system.

However, in the last few years a breakthrough has been achieved in the form of numerical methods that were developed initially by quantum information theorists. These methods make possible the simulation of many-body dynamics for low-energy systems in one dimension by a systematic reduction of the Hilbert space.

I will give an introduction to these many-body systems, and the recently developed numerical methods. I will illustrate this with some of the results of our work in applying these methods to systems of cold atoms in optical lattices (which are present in experiments in many places, including Innsbruck), and discuss briefly the mathematical challenges in attempting to extend these methods to higher dimensions, as well as the importance to physicists of such an extension.

Zeit: **Dienstag, den 27. Mai 2008 um 17:15 Uhr**

Ort: **Viktor-Franz-Hess-Haus, Technikerstraße 25, HS F**

Alexander Ostermann/ Mechthild Thalhammer

Gäste sind herzlich willkommen!