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To all members of the
Faculty of Physics

Vienna, 09 December 2016

Invitation to the public defense of the doctoral thesis

On the Quantum Gross-Pitaevskii Equation

by

Damian Draxler

Friday, 16 December 2016, 17:00

Josef-Stefan lecture hall, 3rd floor, Boltzmannngasse 5, 1090 Vienna

Abstract

This thesis is concerned with the development of new variational algorithms to study strongly correlated one dimensional quantum field theories. To this end we apply the Dirac-Frenkel time-dependent variational principle to the class of continuous Matrix Product States which are a certain type of tensor-network states. Three main results are presented: an ansatz for low lying excitations, a time-evolution algorithm for systems with open boundary conditions and a time evolution algorithm for systems with periodic boundary conditions. These algorithms can be applied equally well to finite translationally and non-translationally invariant systems, to systems in the thermodynamic limit and to both relativistic and non-relativistic theories. Moreover, we thereby generalize the theory of Gross and Pitaevskii to the case of strongly correlated one dimensional systems where mean-field descriptions typically fail. Our generalization includes the Gross-Pitaevskii equation in the mean-field limit but goes well beyond this regime by capturing entanglement and quantum correlations.

Defense committee:

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