

CONDENSED MATTER THEORY SEMINAR

Subject: **Fundamental limitations for measurements in quantum many-body systems**

Speaker: **Prof. Dr. Thomas Barthel, Duke University, Durham, USA**

Date & time: **Friday, May 24th, 2019 at 3:15 p.m.**

Venue: **Seminar room 1.114**

Dynamical measurement schemes are an important tool for the investigation of quantum many-body systems, especially in the age of quantum simulation. Here, we address the question whether generic measurements can be implemented efficiently if we have access to a certain set of experimentally realizable measurements and can extend it through time evolution. For the latter, two scenarios are considered (a) evolution according to unitary circuits and (b) evolution due to Hamiltonians that we can control in a time-dependent fashion.

We find that the time needed to realize a certain measurement to a predefined accuracy scales in general exponentially with the system size - posing a fundamental limitation. The argument is based on the construction of epsilon- packings for manifolds of observables with identical spectra and a comparison of their cardinalities to those of epsilon-coverings for quantum circuits and unitary time-evolution operators. The former is related to the study of Grassmann manifolds. The results show that it is a question of clever design to allow for the measurement of observables of interest through efficient dynamical schemes and a suitable encoding of models in quantum simulation protocols.

Ref: T. Barthel and J. Lu, Phys. Rev. Lett. 121, 080406 (2018)