

**Announcing the Final Examination of Sabine Pelton for the Degree of
Doctor of Philosophy in Physics**

Date: Thursday, August 17, 2017

Time: 10:00 a.m.

Room: PSB 160

Dissertation title:

Solving Constraint Satisfaction Problems with Matrix Product States

Abstract:

In the past decade, Matrix Product State (MPS) algorithms have emerged as an efficient method of modeling some many-body quantum spin systems. Since spin system Hamiltonians can be considered constraint satisfaction problems (CSPs), it follows that MPS should provide a versatile framework for studying a variety of general CSPs. In this thesis, we apply MPS to two types of CSP. First, we use MPS to simulate adiabatic quantum computation (AQC), where the target Hamiltonians are instances of a fully connected, random Ising spin glass. Results of the simulations help shed light on why AQC fails for some optimization problems. We then present the novel application of a modified MPS algorithm to classical Boolean satisfiability problems, specifically k-SAT and max k-SAT. By construction, the algorithm also counts solutions to a given Boolean formula (#-SAT). For easy satisfiable instances, the method is more expensive than other existing algorithms; however, for hard and unsatisfiable instances, the method succeeds with subexponential scaling where other algorithms fail to converge.

Outline of Studies:

Major: Physics

Educational Career:

M. S. University of Central Florida, USA, 2012

‘ B. S. University of Texas at Arlington, USA, 2007

Committee in Charge:

Dr. Eduardo Mucciolo (Chair)

Dr. Aniket Bhattacharya

Dr. Richard Klemm

Dr. Pawel Wocjan (External Committee Member)

Approved for distribution by Dr. Eduardo Mucciolo Committee Chair, on July 10, 2017.

The public is welcome to attend.