Institute for Advanced Simulation
Jülich Supercomputing Centre

IAS Seminar

Topic: Simulation of a 3-dimensional transverse Ising system with a D-Wave quantum annealing processor

Speaker: Dr. Richard G. Harris, D-Wave Systems Inc., Burnaby, Canada

Contents: A prototype quantum annealing processor has been used to simulate an 8x8x8 cubic lattice of Ising spins coupled to a thermal bath at temperature T and subject to a transverse magnetic field Ht. The lattice was formed by representing the individual Ising spins using strongly coupled chains of flux qubits and choosing a subset of interqubit couplers to represent the nearest neighbour couplings of the cubic lattice. The low energy Hamiltonian of the processor then mapped onto that of the desired system. The ground state of the Ising spin system was tuned by choosing a fraction 1-p of the nearest neighbour interactions to be antiferromagnetic (AFM) and the remaining fraction p to be ferromagnetic (FM). Measurements of the antiferromagnetic order parameter, dc magnetic susceptibility, and hysteresis were used to identify paramagnetic (PM) to AFM and PM to spin glass (SG) phase transitions as a function of p, T, and Ht. The efficacy of quantum fluctuations induced by Ht versus thermal fluctuations in reducing the free energy of the Ising spin system was studied by examining energy distributions from repeated runs using multiple annealing paths.

Time: Friday, 3 February 2017, 10:30

Venue: Jülich Supercomputing Centre, Rotunda, building 16.4, room 301

sgd Prof. Dr. Stefan Blügel