



量子物理学・ナノサイエンス第 231 回セミナー

## Quantum simulation using a D-Wave 2000Q quantum annealing processor

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### 概 要

The D-Wave 2000Q ([www.dwavesys.com](http://www.dwavesys.com)) is a physical implementation of the quantum annealing algorithm based on the transverse Ising model. It is built using 2048 superconducting flux qubits operated at a temperature of 10 millikelvin. While much work using the D-Wave 2000Q has focused on the application of the quantum annealing algorithm to attack classical optimization problems, we have recently been investigating its use as a tool for quantum simulation. I will present two experiments using the quantum processor as a quantum simulator. First, we measured a Kosterlitz-Thouless phase transition in a 2D lattice of 1800 qubits, induced by the interplay between quantum fluctuations and geometrical frustration. Second, we studied a prototypical quantum magnetic system, an 8x8x8 cubic lattice of effective Ising spins: by tuning the transverse magnetic field and the degree of disorder, we demonstrate transitions between paramagnetic, antiferromagnetic, and spin glass phases. Finally, I will discuss work on our next generation quantum annealing processor focusing on improved coherence and connectivity.

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