

## 博士論文公聴会の公示（物理学専攻）

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論文題目：Quantum Dynamics and Computation with D-Wave Machine  
（量子ダイナミクスと D-Wave マシンを用いた計算）

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論文要旨：

Recent advances in quantum computing and quantum information have clarified the potential of the technology to accelerate a lot of principal science and engineering applications, including high energy physics, condensed matter physics, quantum chemistry and data science. As such, there is a growing demand to expand the testability and the programmability of quantum devices. In this thesis we explore quantum dynamics of several models that are used for quantum annealing and study applications of quantum annealing with D-Wave quantum annealer. Especially we consider quantum phase transitions that occur while quantum annealing from a view point of quantum chaos and quantum scrambling. In addition we offer a new model for which non-stoquastic dynamics can turn a first-order phase transition into a second-order phase transition. Moreover we formulate the nurse scheduling problem as a quadratic unconstrained binary optimization (QUBO) problem and solve it with D-Wave 2000Q. Furthermore superconducting qubits can be also applied to quantum simulation and useful to reproduce any exotic complex quantum behaviour. One of the famous example is the fractal energy structure of electrons. We investigate fractal energy spectrum of electrons on a lattice with a single point defect. This novel property should be confirmed experimentally with qubits or real material.