POSTDOCTORAL FELLOWSHIPS on NISQ ERA QUANTUM COMPUTATION

The University of British Columbia

The UBC Stewart Blusson Quantum Matter Institute http://qmi.ubc.ca invites applications for a total of five highly motivated postdoctoral fellows, four in theory and one in experiment, to support activity in the study of quantum computation in the NISQ era. SBQMI has just launched the Grand Challenge entitled "Pushing the boundaries of noisy intermediate scale quantum computing'', a program geared towards the study of quantum algorithms that can be run on present-day and near future quantum computing devices. The initial focus is on quantum algorithms that require up to 100 qubits and 10,000 quantum gates. As for applications, of particular interest are problems in quantum material science, and fermionic systems such as the fermionic Hubbard model and Kondo physics. From the perspective of methods, machine learning, quantum simulation (analog and digital) and symmetry analysis (e.g. symmetry protected topological order) are emphasized.

For more information on the Grand Challenges, please see https://qmi.ubc.ca/grand-challenges

Available Postdoctoral Fellowship positions

Machine learning for the extrapolation and inverse problems (Roman Krems)
Development of codes for generalization of high-dimensional sparse data with Gaussian processes for applications to extrapolation in the Hamiltonian parameter space and solving inverse problems in quantum physics. Development of new algorithms for generalization with Bayesian machine learning. Coordinating with other postdoctoral fellows and students to apply algorithms and codes to specific quantum materials problems. Coordinating with a research associate on the development and implementation of algorithms for training Gaussian processes with composite kernels on quantum hardware. Development of new theory and algorithms for machine learning based on quantum hardware. Development of user-friendly applications based on the codes produced.

Experiments in quantum hardware (Joe Salfi)
This position will lead fabrication and experiments on a quantum simulator implemented using coupled quantum dots, together with one or more graduate students. The target of the quantum simulation will be to probe phenomenology of the resonating valence bond states both at half-filling of a small two-dimensional lattice, and away from half-filling. Responsibilities include device fabrication, cryogenic experimental design, cryogenic experiments, data analysis, and supervision of graduate students. The postdoc will work closely with a theory postdoc on applying machine learning techniques, with guidance from Krems, Affleck, and Raussendorf.

Algebraic methods in quantum computing (Ian Affleck and Robert Raussendorf)
Development of novel methods for mapping Fermionic systems to bosons. Collaborations with research associate and other postdoctoral fellows on how the Kondo screening cloud could be seen in a quantum algorithm. Classification of measurement-based quantum computation within the framework of symmetry protected topological order. The candidate should have a background in both quantum information and condensed matter physics; the former covering computational models such as circuit, measurement-based, adiabatic and topological, plus quantum error correction and the stabilizer formalism. The latter should cover fermionic systems and symmetry-protected topological order, and topological order. Minimal algorithms.

This postdoc position is part of the Quantum Computing Theory (QCT) building pillar, so there is no quantum algorithm development.

Quantum algorithms (Robert Raussendorf, Ian Affleck, Sarah Burke, Joe Salfi)
Work with algorithms examining Kondo, Hubbard, (existing quantum hardware, Adiabatic protocols), symmetry-protected topological (SPT), classical simulation of small-scale algorithms; analysis of operational requirements and decoherence; running small-scale quantum algorithms on the existing platforms for quantum computation. Benchmarking and constraint analysis.

Hybrid Machine Learning algorithms for specific, real materials problems (Mona Berciu, Jeff Young, Lukas Chrostowski, Sarah Burke)
Algorithmic work with solar energy transducers, quantum emitters, and others. Identifying relevant Hamiltonian models for the specified problems and figuring out how to solve them in various limits. Interfacing with other postdoctoral fellows to incorporate these solutions, and experimental results, into first classical machine learning routines, and eventually into hybrid approaches that utilize quantum algorithms to enhance the machine learning.

The SBQMI Postdoctoral Fellowships offer competitive salary support and benefits (including extended health and dental coverage) and the opportunity to work with the world-leading groups at the UBC SBQMI and their international research partners.

Candidates must have a PhD in a relevant discipline and be able to demonstrate a solid scientific background—as evidenced by publication record, letters of recommendation, and research proposal. Evidence of teamwork, strong communication skills, and ability to supervise students will also be considered. We have immediate openings for all of these postings. Candidates who are in the process of completing their doctoral degree and expect to complete by June 2020 are also welcome to apply.

To apply, please provide:

- Brief cover letter, including the SBQMI researcher(s) with whom you have discussed projects, and the names of those who will provide recommendations;
- Curriculum Vitae, including full publication list;
- 1 – 2 page research proposal;
- 3 letters of recommendation (to be sent directly by your referees).

Candidates: submit your application online at www.facultycareers.ubc.ca/35945
Referees: please email letters of recommendation to jobs@qmi.ubc.ca

Application deadline: December 15, 2019

Equity and diversity are essential to academic excellence. An open and diverse community fosters the inclusion of voices that have been underrepresented or discouraged. We encourage applications from members of groups that have been marginalized on any grounds enumerated under the B.C. Human Rights Code, including sex, sexual orientation, gender identity or expression, racialization, disability, political belief, religion, marital or family status, age, and/or status as a First Nation, Metis, Inuit, or Indigenous person.

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THE UNIVERSITY OF BRITISH COLUMBIA