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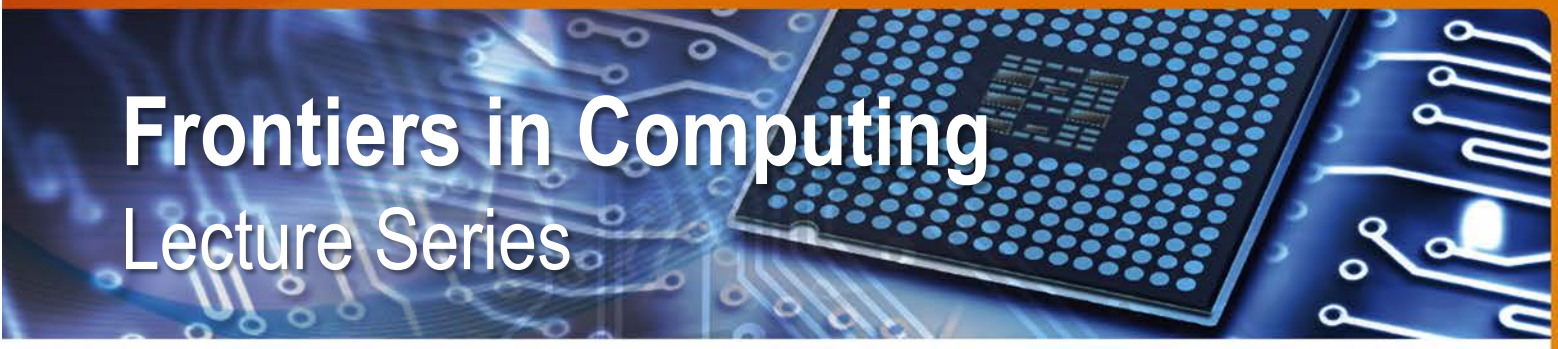

Frontiers in Computing
Lecture Series

Towards a Quantum Future of Computation

Matthias Troyer, Ph.D.

Principal Researcher, Microsoft Quantum Architectures and Computation Group
(on leave from the Swiss Federal Institute of Technology ETH Zurich)

Friday, January 27, 2017 ◈ 11 AM
BSF Crick Room (2008)

Dr. Troyer is a recipient of the American Physical Society 2016 Aneesur Rahman Prize for Computational Physics and a European Research Council Advanced Grant. He also is an APS Fellow and a Trustee of the Aspen Center for Physics. His research activities center on large-scale simulations of quantum systems, development of new simulation algorithms, and high-performance computing. Combining his interests in supercomputing and quantum physics has led him to quantum devices. He has tested quantum random number generators, validated analog quantum simulators for materials, explored the computational capabilities of quantum annealers, and now works on commercially relevant applications of quantum computers. He obtained his Ph.D. in physics in 1994 from ETH Zurich and spent three years as postdoc at the University of Tokyo before returning to ETHZ, where he has been full professor since 2005.

More than a century after the development of quantum mechanics, we have reached an exciting time where non-trivial devices that use quantum effects can be built. Quantum random number generators produce true random numbers, optical lattice emulators mimic models of condensed matter physics, and quantum annealers solve classical optimization problems. As the roadmap to building universal quantum computers becomes more concrete, an emerging question is the identification of important real-world applications. For a quantum computer to be competitive, it needs to not only be asymptotically superior but able to solve problems within a limited time that no classical supercomputer can solve. Dr. Troyer will discuss the necessary steps of quantum software engineering needed to turn a quantum algorithm into a "quantum killer app." He also will review how substantial improvements of quantum algorithms have turned problems in materials science and quantum chemistry to realistic applications of quantum computers, from novel superconductors to understanding the mechanism of biological nitrogen fixation.

Host: Nathan Baker (nathan.baker@pnnl.gov), ACMD Division Director

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