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Quantum Computation and Quantum Error Correction

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Abstract:

The promise of quantum computation is the ability to solve certain computational problems that would be of wide practical use. Such problems include integer factorization, unstructured search, and simulation of quantum systems (to name a few). Before realizing such a promise, quantum computers will have to fight against the debilitating effects of noise or decoherence. It is particularly difficult for quantum data to stay intact because not only must we correct "bit-flip" errors that occur in classical computation but also "phase-flip" errors which occur in quantum systems. Fortunately, the theory of quantum error correction provides a way to fight the decoherence enemy as long as its strength is not too high. In this talk, I will review the basics of quantum computation and quantum error correction. I will then highlight progress on numerical simulations of quantum error correction routines for fault tolerant quantum computation and for distributed quantum computation between nodes in a quantum computer.

Speaker's Bio:

Mark M. Wilde received the Ph.D. degree in electrical engineering from the University of Southern California in 2008. Currently, he is a Postdoctoral Fellow at McGill University. He has published over 55 articles and preprints in the area of quantum information processing. His current research interests are in quantum error correction, quantum Shannon theory, and applications of these ideas to other areas of physics. He is the author of the textbook "Quantum Information Theory" to be published by Cambridge University Press later this year.

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