General Seminar:

3:40PM / Thursday, 7 April 2005 / Room 109, Nicholson Hall
Host: Dr. Jonathan Dowling
[Refreshments served at 3:15 PM in Room 229, Nicholson Hall]

"How to Build a Fault-tolerant Quantum Computer"

Prof. Andrew Landahl
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Abstract

Quantum computers can solve problems far beyond the reach of current or future classical computers. At the same time, they are much more sensitive to noise, making their construction a technological challenge. A revolution in the past decade was the discovery of quantum error correction — noise in quantum computers can be reversed with clever use of quantum correlations known as entanglement. I will describe how this works, and how to extend these ideas to account for faults in the error correction process itself. The central result I will present is the threshold theorem: if all noise is brought below a critical threshold level, then arbitrarily long quantum computations are possible. I will relate recent results linking the value of this threshold to the location of a phase boundary in a particular quantum phase transition. I will also highlight how this suggests quantum computing architectures in which quantum computers "fix themselves" via cleverly engineered local quantum physics.

Publications:

"Consistent Discretization and Loop Quantum Geometry." Rodolfo Gambini and **Jorge Pullin**. *Phys. Rev. Lett.* 94, 101302-[4] (March 2005).

Announcements and Reminders:

There will be a Faculty Meeting on Tuesday, April 5, at 3:40 PM in Room 109, Nicholson.