LSU LOUISIANA STATE UNIVERSITY

PHYSICS & ASTRONOMY
WEEKLY CALENDAR

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WEEKLY CALENDAR

February 22, 2010

Departmental Colloquium

"Quatum Computers and Decoherence: Exorcising the Demon from the Machine"

3:40 PM, February 25, 2010
109 Nicholson Hall

Daniel Lidar
University of Southern California

Host: Jonathan Dowling

• Refreshments served at 3:15 PM in 232 (Library) Nicholson Hall •

Recently discovered algorithms indicate that quantum computers may one day enable exponentially faster computation than is fundamentally possible using their classical counterparts. The realization of this promise hinges above all on the ability to protect quantum computers against the deleterious effect of the interaction with their environment, leading to decoherence. A decohered quantum computer is equivalent to a badly malfunctioning classical computer. In this talk I will first briefly review the what's, why's, how's and problems of quantum computation. This will be followed by a proposal for a solution of the decoherence problem, with applications to atomic and solid-state quantum computing. Two key ingredients of the proposed solution are "decoherence-free subspaces" and "dynamical decoupling". In the decoherence-free subspace approach, a symmetry in the system-environment interaction is sought. Provided such a symmetry exists quantum information appears as a conserved quantity, that cannot decohere. Dynamical decoupling is a method that applies strong and fast pulses to the system (similar to the spin-echo effect) in order to enforce such a symmetry on the system-environment interaction. The combination of decoherence-free subspaces and dynamical decoupling is a powerful tool for fighting decoherence, and is fully compatible with quantum computation in a wide range of proposed implementations of quantum computers.

Announcement:

The Research team led by **Mark Jarrell**, Dept. of Physics and Astronomy, and the Center for Computation & Technology is one of the recipients for the 2010 Innovative and Novel Computational Impact on Theory and Experiment, or INCITE, program awards.

Publications:

"Undecidability and the Problem of Outcomes in Quantum Measurements," Rodolfo Gambini, Luis Pedro Garcia Pintos, **Jorge Pullin**, Found Physics (2010) 40: 93-115.