Chez Pierre

Presents ...

Thursday, March 8, 2012
10:30am
MIT Room 4-331

SPECIAL CHEZ PIERRE SEMINAR

Oliver Dial
Harvard University

"Realizing Two-Qubit Gates in Singlet-Triplet Qubits"

Singlet-Triplet qubits, comprised of pairs of electron spins in semiconductor quantum dots, offer long coherence times, fast, high-fidelity readout and initialization, and the scalability advantages of semiconductor technologies. Pulsed electric fields provide universal single-qubit quantum control in these devices; the gate-controllable exchange interaction can be used to tune the splitting between the singlet and triplet states, while a static magnetic field gradient provides rotation between these states. However, one additional tool is needed to construct a universal quantum computer from these devices, namely a two qubit gate where the state of one qubit conditions a logical operation on another qubit. To implement this essential operation, we construct two adjacent singlet-triplet qubits and use the electrostatic coupling between them to generate a CPHASE gate. In the first realization of a two-qubit gate operation between two fully-functional spin qubits, we use this gate to produce a Bell state with a fidelity substantially exceeding 0.5, the threshold needed to prove entanglement.