The Fall 2007 Condensed Matter Seminar series presents:

Prof. Carlo Piermarocchi

(Michigan State University)

"Cavity Quantum Electrodynamics and Quantum Computing Architectures"

Abstract:

A quantum computer is a device for computation that makes direct use of distinctively quantum mechanical phenomena, such as superposition and entanglement, to perform operations on data. The logical unit of a quantum computer is the qubit, and, as in a classical computer, complex algorithms can be built from simpler single-qubit and two-qubit operations. In many quantum computing architectures individual qubits need to be placed close enough - nanometers apart - to ensure an effective two-qubit operation. This is technologically challenging, especially in the case of semiconductor-based implementations with quantum dots or localized impurities.

One way to overcome these limitations involves the use of Cavity Quantum Electrodynamics (QED), i.e. the physics of confined photons interacting with matter. I will show how cavity QED effects can be used to couple qubits at large separation in a semiconductor-based quantum computer. The key role in the two-qubit operation is played by peculiar states, called cavity polaritons, with a half-matter and half-light character.

Mon., Oct. 1 4:00 P.M. 304 Robeson