

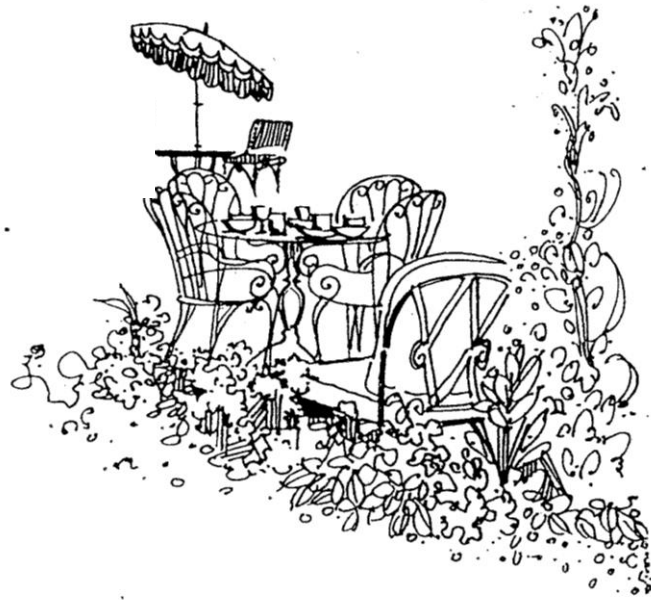
# *Chez Pierre*

Presents ...

**Thursday, March 3, 2011**

**11:00am**

**MIT Room 4-331**



## **SPECIAL CHEZ PIERRE SEMINAR**

**Rajamani Vijayaraghavan**

**University of California - Berkeley**

**“Information processing at the quantum limit:  
Superconducting quantum bits and amplifiers”**

The merger of quantum mechanics and information science in the 21st century has the potential to produce quantum machines capable of solving classically intractable problems as well as to define a new modality for communication and metrology. These machines can be constructed not only from microscopic systems like atoms and photons, but also from macroscopic superconducting electrical circuits engineered to exhibit quantum superposition and entanglement. The latter approach offers several advantages: wide tunability, strong electronic coupling, and large scale integration. I will describe the design and operation of superconducting quantum bits—the building blocks of a quantum processor. In particular, I will focus on high fidelity quantum state measurements using an ultralow noise parametric amplifier operating at the quantum noise limit. This device has enabled us to monitor the qubit state in real time, leading to the first observation of quantum jumps in an electrical circuit. Such capability opens the door for quantum feedback control and error correction, a crucial component of quantum information processing. I will also discuss the use of superconducting measurement technology to probe solid state electron spins, such as nitrogen vacancy centers in diamond, as a first step towards hybrid quantum circuits.