

Title: Tunnel transistors - can they beat the MOSFET subthreshold-swing-limit of 60mV/decade?

Speaker: Qin Zhang

Abstract:

In a field-effect transistor, the minimum voltage swing needed to turn a transistor from on to off is an important figure of merit which ultimately determines how low in power your device technology can be. This characteristic is usually quantified by measuring how many millivolts it takes to change the drain current by one order of magnitude, i.e. one decade of current on a logarithmic scale. The measure of this characteristic is called the subthreshold slope and is given in units of mV/decade of current change. It is interesting to ask, what is the theoretical limit for this characteristic in the MOSFET, and are there ways to do better? In the MOSFET, the subthreshold swing is limited by thermal voltage, kT/q , which is 60 mV/decade at room temperature. In this talk, we will show theoretically that certain gate-controlled tunnel transistors do not have this limit, and can achieve a lower subthreshold slope. In agreement with this theory are two recently published tunnel transistors which have experimentally demonstrated subthreshold swings less than 60 mV/decade. Given this experimental encouragement, I will describe a new tunnel transistor configuration analyzed by a modified 1D Poisson equation, to achieve low subthreshold slope. We are seeking a better understanding of the fundamental limits of the subthreshold slope in tunnel transistors.

Bio:

Qin Zhang received the B.S. degree in electronic engineering from Tsinghua University in 2003, and then joined the department of electrical engineering, University of Notre Dame for graduate study. Her primary research interest is in nanoscale tunneling devices.