Abstract Submitted
for the MAR06 Meeting of
The American Physical Society

Analysis of microwave-frequency field patterns in an externally-driven Single-Electron Transistor[1] BRYAN HEMINGWAY, ANDREI KOGAN, University of Cincinnati — We report a numerical study of electromagnetic field patterns that emerge in a Single-Electron Transistor (SET) device driven by a microwave-frequency signal. In an SET, an electronic droplet (quantum dot) containing a few electrons is connected to two macroscopic conductors via tunnel barriers, and DC current measurements are used to investigate the quantum properties of the lead-dot system. Our goal is to develop a method for a well-controlled excitation of few-electron devices with microwaves. Such capability is needed for investigating the intrinsic time scales of Kondo-correlated electrons, not accessible in static experiments. We study realistic model geometry of an SET defined lithographically on a semiconductor heterostructure such as GaAs/AlGaAs. We find that at frequencies ~ 10 GHz and above, the microwave voltages across the sub-micron features of the SET can be drastically different from those applied to the large-scale pads and depend in a complex and sensitive way on the excitation frequency, thus presenting a challenge for dynamic transport experiments with SETs. We discuss possible strategies for resolving the problem.

[1]supported by UC startup funds

ANDREI KOGAN
University of Cincinnati

Date submitted: 30 Nov 2005

Electronic form version 1.4