

# Physics Colloquium

UNIVERSITY OF MISSOURI-KANSAS CITY  
DEPARTMENT OF PHYSICS

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**Professor Hui Zhao**  
**University of Kansas - Lawrence**

## **Nanoscale ballistic spin and charge transport studied by optical techniques**

Electronic transport on nanometer dimensions is of fundamental importance in semiconductor nano-electronics. In this talk I will discuss real-space observations of ballistic spin and charge transport in GaAs by ultrafast optical coherent control and pump-probe techniques. I will discuss basic ideas of optical injection of ballistic spin and charge currents through quantum interference of multiple absorption pathways. This is followed by an introduction of optical pump-probe techniques and their application in detecting electrons in semiconductors. Using these techniques, the ultrafast evolution of ballistic pure spin currents, pure charge currents and spin-polarized charge currents are directly observed in real space with 200 femtosecond temporal resolution and 1 nanometer spatial resolution. I will also discuss the application of these techniques to study both the ordinary and the inverse spin Hall effects in the ballistic regime.

**Physics Department**  
**Robert H. Flarsheim Science & Technology Hall**  
**5110 Rockhill Road**  
**University of Missouri-Kansas City**

**December 9, 2007**

**Coffee at 3:10, Colloquium at 3:30 in Room 310**