Physics
AT QUEENS COLLEGE

Colloquium Notice

Sergey Vitkalov

City College of CUNY

Joule heating in systems with discrete spectra

The quantization of electron motion in magnetic fields generates a plethora of fascinating phenomena observed in condensed materials. One of the well-known examples is the Shubnikov-de Haas (SdH) resistance oscillations. In two dimensional electron systems, SdH oscillations can be very pronounced leading to the Quantum Hall Effect (QHE) at low temperatures.

Landau quantization produces a remarkable effect on Joule heating of two dimensional (2D) electrons. The heating forces 2D electrons into exotic electronic states in which voltage (current) does not depend on current (voltage). In contrast to the linear response at low temperatures (SdH, QHE), the quantization affects Joule heating in a significantly broader temperature range. At temperatures significantly exceeding the cyclotron energy the dc heating produces a multi-tiered electron distribution containing as many tiers as the number of Landau levels inside the energy interval kT. This quantal heating preserves the overall broadening of the electron distribution. Surprisingly the distribution resulting from quantal heating is, in some respect, similar to the one created by the quantum microwave pumping between Landau levels. Indicated phenomena produce a broad variety of nonlinear effects in quantizing magnetic fields and present an exciting area of the contemporary research. In this talk a recent experimental investigations of the dynamics of quantal heating are presented indicating an important role of the electron-electron interaction in the relaxation of the electron distribution.

Monday
February 8, 2016
Starts at 12:15 PM
Coffee at 12:00 PM
Physics Conference Room, SB B326