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Asymmetry of Nonlinear Transport and Electron Interactions in Quantum Dots D. M. ZUMBÜHL, MIT and Harvard University, C. M. MARCUS, Harvard University, M. P. HANSON, UCSB, A. C. GOSSARD, UCSB —
The magnetic field symmetry of conductance beyond the linear source-drain bias regime in open chaotic GaAs quantum dots is experimentally investigated using gate-controlled shape distortion to gather ensemble statistics. We measure a conductance component g_{B-} antisymmetric in perpendicular magnetic field B which is of the form $\tilde{g} = \alpha VB$ for source-drain bias voltages V smaller than the quantum dot level spacing Δ and for B smaller than a flux quantum through the device area. Interestingly, according to recent theories, $\tilde{g}$ of this form vanishes in absence of electron interactions and α is proportional to the electron interaction strength. g_{B-} shows mesoscopic fluctuations with shape gate and with B and V on a scale of the flux quantum through the dot area and quantum dot level spacing Δ, respectively. As anticipated by theories, the average coefficient α measured over an ensemble of dot shapes vanishes. The standard deviation of α is used to characterize the strength of electron interactions. We discuss the dependence of the typical α on the number of modes in the quantum-point-contact leads, compare our experiment with theories and discuss related issues of electron equilibration, decoherence and thermal smearing in the quantum dot. This work was partially supported by DARPA QuIST, ARO/ARDA and by the NSEC program of the NSF.

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