Rectification and nonlinear transport through chaotic dots and rings

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We investigate weakly non-linear current-voltage characteristic of mesoscopic conductors and the dc generated through rectification of an alternating bias. This current can be described by second order conductances wich randomly fluctuate from sample to sample. Due to Coulomb interactions the symmetry of transport under magnetic field inversion is broken, and we consider both the symmetric and anti-symmetric non-linear conductances separately. DC is determined by different combinations of non-linear conductances depending on the way voltages are varied (bias mode). We discuss the role of the bias mode in recent experiments. In a photovoltaic experiment the fluctuations of the non-linear conductance strongly depend on the bias mode and decrease with frequency. To investigate non-linear transport in chaotic rings we develop a model which combines a chaotic quantum dot and a ballistic arm to enclose an Aharonov-Bohm flux. In the linear conductance the phase of the Aharonov-Bohm oscillations is pinned while in non-linear transport phase rigidity is lost. We discuss the shape of the mesoscopic distribution of the phase and determine the phase fluctuations.