# Effects of strong internal forces on microwave-induced magneto-oscillations in surface electrons on liquid helium

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Microwave-induced oscillations of longitudinal conductivity were recently observed in two-dimensional electron system on the surface of liquid helium.[1] This phenomenon shows striking similarities to microwave-induced resistance oscillations and zero-resistance states observed in high-mobility 2D electron gas in GaAs/AlGaAs heterostructures.[2] A theory was proposed, which explains the appearance of oscillations in the electron system on helium as a result of a new mechanism of momentum relaxation of microwave-excited electrons as they scatter elastically between the excited subband to the ground subband.[3] The theory also predicts strong effects of electron-electron interaction in this system. Here we report on the experimental observation of the predicted many-electron effects on amplitude and phase of magneto-oscillations for electrons on liquid $^3$He. In particular, we show that observed broadening of the oscillations, shift of the conductivity extremes, and suppression of the zero-resistance states with increasing electron density can be explained by the influence of the internal many-electron fluctuating electric field. Our results provide important evidences in favor of the new relaxation mechanism proposed earlier.[3]

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