Cyclotron-resonance-induced dynamics of the electrons-on-helium system

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We report an experimental study of surface electrons on liquid helium-4 under the cyclotron resonance excitation. The observed conductivity response has a structure of two resonant lines, which strongly depends on the excitation intensity and the electron confinement potential. When the excitation intensity is high enough, electrons can partially escape from the potential trap, being significantly overheated by the resonant absorbtion. The transient response of surface electrons to switching the cyclotron resonance excitation on and off reveals complicated dynamics, which includes the electron density redistribution towards the boundaries of the confinement area, as well as the formation of a quasi-3D fraction of electrons. Both conductivity and transient responses are reminiscent of the phenomena observed under the surface state resonance excitation in quantizing magnetic field[1,2].

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