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标题: Wave excitations of drifting two-dimensional electron gas under strong inelastic scattering
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摘要: We have analyzed low-temperature behavior of two-dimensional electron gas in polar heterostructures subjected to a high electric field. When the optical phonon emission is the fastest relaxation process, we have found existence of collective wave-like excitations of the electrons. These wave-like excitations are periodic in time oscillations of the electrons in both real and momentum spaces. The excitation spectra are of multi-branch character with considerable spatial dispersion. There are one acoustic-type and a number of optical-type branches of the spectra. Their small damping is caused by quasi-elastic scattering of the electrons and formation of relevant space charge. Also there exist waves with zero frequency and finite spatial periods-the standing waves. The found excitations of the electron gas can be interpreted as synchronous in time and real space manifestation of well-known optical-phonon-transient-time-resonance. Estimates of parameters of the excitations for two polar heterostructures, GaN/AlGaN and ZnO/MgZnO, have shown that excitation frequencies are in THz-frequency range, while standing wave periods are in sub-micrometer region. (C) 2012 American Institute of Physics. [http://dx.doi.org/10.1063/1.4759277]
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