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标题: Ultrafast nonlinear terahertz studies of high-field charge transport in semiconductors

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摘要: Nonlinear terahertz (THz) spectroscopy gives insight into high-field charge transport in semiconductors. Strong THz transients with field amplitudes of up to megavolts/cm serve as a driving field for free carriers and the resulting transport behavior is directly inferred from the field radiated by the moving charges. We study the transition from a ballistic to a drift-like transport regime of electrons in bulk GaAs. While electrons in the lowest conduction band of an n-type sample display ballistic transport, a transition to a drift-like behavior is found in an optically generated electron-hole plasma. Time-resolved measurements reveal the onset of friction on a time scale of a few picoseconds, mainly due to interactions of electrons with the hole distribution heated by the intense THz driving field. Experiments in which photoexcited electrons undergo intervalley scattering from the G to the L valley reveal characteristic changes of the transport behavior due to the picosecond backscattering to the G valley. The experimental results are in agreement with theoretical calculations of the time-dependent friction including both electron-hole scattering and local-field effects.

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