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Nonlinear THz absorption and cyclotron resonance in InSb.[1]
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The emergence of coherent high-field terahertz (THz) sources in the past decade has allowed the exploration of nonlinear light-matter interaction at THz frequencies. Nonlinear THz response of free electrons in semiconductors has received a great deal of attention. Such nonlinear phenomena as saturable absorption and self-phase modulation have been reported. InSb is a narrow-gap (bandgap 0.17 eV) semiconductor with a very low electron effective mass and high electron mobility. Previous high-field THz work on InSb reported the observation of ultrafast electron cascades via impact ionization. We study the transmission of an intense THz electric field pulse by an InSb wafer at different incident THz amplitudes and 10 K temperature. Contrary to previous reports, we observe an increased transmission at higher THz field. Our observation appears similar to the saturable THz absorption reported in other semiconductors. Along with the increased absorption, we observe a strong modulation of the THz phase at high incident fields, most likely due to the self-phase modulation of the THz pulse. We also study the dependence of the cyclotron resonance on the incident THz field amplitude. The cyclotron resonance exhibits a lower strength and frequency at the higher incident THz field.

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