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Title:Plasmon dynamics in colloidal Cu2-xSe nanocrystals
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Abstract:The optical response of metallic nanostructures after intense excitation with femtosecond-laser pulses has recently attracted increasing attention: such response is dominated by ultrafast electron-phonon coupling and offers the possibility to achieve optical modulation with unprecedented terahertz bandwidth. In addition to noble metal nanoparticles, efforts have been made in recent years to synthesize heavily doped semiconductor nanocrystals so as to achieve a plasmonic behavior with spectrally tunable features. In this work, we studied the dynamics of the localized plasmon resonance exhibited by colloidal Cu2-xSe nanocrystals of 13 nm in diameter and with x around 0.15, upon excitation by ultrafast laser pulses via pump-probe experiments in the near-infrared, with ~200 fs resolution time. The experimental results were interpreted according to the two-temperature model and revealed the existence of strong nonlinearities in the plasmonic absorption due to the much lower carrier density of Cu2-xSe compared to noble metals, which led to ultrafast control of the probe signal with modulation depth exceeding 40% in transmission.
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