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Title:Ultrafast field-resolved semiconductor spectroscopy utilizing quantum interference control of currents

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Abstract:We implement a versatile concept to time-resolve optical nonlinearities of semiconductors in amplitude and phase. A probe pulse transmitted through the optically pumped sample is superimposed with first subharmonic spectral components derived from the same laser source. This effective $\omega/2$ ω pulse pair induces a coherently controlled current in a time-integrating semiconductor detector. Current interferograms obtained by scanning the $\omega/2$ ω time delay then reveal the electric field of the 2ω part as well as its pump-induced modifications. As a paradigm we analyze the excitonic optical nonlinearity of a CdTe thin film at frequencies around 385 THz. We then move onto resolve the pump-induced amplitude- and phase-distortions of a probe pulse related to two-photon absorption and cross-phase modulation in ZnSe.

Number of references:12

Inspec controlled terms:cadmium compounds - excitons - II-VI semiconductors - optical pumping - quantum interference phenomena - semiconductor thin films - time resolved spectra - two-photon processes - wide band gap semiconductors - zinc compounds

Uncontrolled terms:ultrafast field-resolved semiconductor spectroscopy - quantum interference control - time-resolve optical nonlinearity - probe pulse - optically pumped sample - subharmonic spectral components - laser source - $\omega/2$ ω pulse pair - time-integrating semiconductor detector - pump-induced modifications - excitonic optical nonlinearity - CdTe thin film - amplitude-distortion - phase-distortion - two-photon absorption - cross-phase modulation - CdTe - ZnSe

Inspec classification codes:A6855 Thin film growth, structure, and epitaxy - A7320M Collective excitations (surface states) - A7847 Ultrafast optical measurements in condensed matter - A7865K Optical properties of II-VI and III-V semiconductors (thin films/low-dimensional structures) - A7335 Mesoscopic systems and quantum interference - A7135 Excitons and related phenomena - B2520D II-VI and III-V semiconductors

Chemical indexing:CdTe Cd Te ZnSe Se Zn

Treatment:Theoretical or Mathematical (THR); Experimental (EXP)

Discipline:Physics (A); Electrical/Electronic engineering (B)

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