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Title

Optical and photocurrent spectroscopy with picosecond strain pulses

Source

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Abstract

This paper gives an overview of optical experiments using picosecond strain pulses. The strain pulses, which propagate with the sound velocity, are incident on a semiconductor nanostructure and induce an ultrafast shift of the exciton resonance energy by an amount, that exceeds the spectral width of the corresponding optical transition. When the duration of the high-amplitude strain pulse is long enough compared with the coherence time of the optical resonance, modulation of the resonance takes place adiabatically and exciton energy can be accurately defined at each momentary position. If the coherence time exceeds the characteristic time of the strain pulse, a non-adiabatic regime is realized and the exciton cannot be related to an optical transition with a specific photon energy. In more detail, we describe the recent experiments on the gating of photocurrent in a tunneling p-i-n device and the generation of THz polariton sidebands in an optical microcavity strongly coupled to the excitons in an embedded quantum well. These two experiments represent, respectively, examples of adiabatic and non-adiabatic behaivior of excitons in the presence of the high-amplitude picosecond strain pulse. (22 References).