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Nonlinear Optical Processes Due to Polaritons and Biexcitons in a Microcavity Enclosed Quantum Well

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Abstract

A theoretical investigation of one- and two-photon absorption of weak probe light, respectively, by exciton-polaritons and biexcitons in the presence of a strong laser pulse in a planar microcavity embedded quantum well is presented. The strong pulse pumps the lower branch polariton into the biexciton and both states undergo the optical Stark splitting, which manifests itself in the above mentioned absorption spectra. Besides the usual polariton gap an additional forbidden region for the pump and probe frequencies appears. This is due to the fact that the most part of the lower polariton branch is below the cavity photon mode energy. For this reason the optical Stark effect manifests itself better in the biexciton two-photon absorption spectrum, while the renormalized lower branch polariton is not completely revealed in the one-photon absorption.