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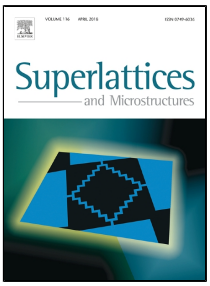

Four-wave mixing in an asymmetric double quantum dot molecule

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Four-wave mixing in an asymmetric double quantum dot molecule

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Abstract

The four-wave mixing (FWM) effect of a weak probe field, in an asymmetric semiconductor double quantum dot (QD) structure driven by a strong pump field is theoretically studied. Similarly to the case of examining several other nonlinear optical processes, the nonlinear differential equations of the density matrix elements are used, under the rotating wave approximation. By suitably tuning the intensity and the frequency of the pump field as well as by changing the value of the applied bias voltage, a procedure used to properly adjust the electron tunneling coupling, we control the FWM in the same way as several other nonlinear optical processes of the system. While in the weak electron tunneling regime, the impact of the pump field intensity on the FWM is proven to be of crucial importance, for even higher rates of the electron tunneling it is evident that the intensity of the pump field has only a slight impact on the form of the FWM spectrum. The number of the spectral peaks, depends on the relation between specific parameters of the system.

Keywords: Four-wave mixing, asymmetric quantum dot molecule, gate voltage, two-subband system, intersubband transition, pump electromagnetic field

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