

The Second-Order Nonlinear Optical Susceptibilities of an Asymmetric Rectangular Quantum Well

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Abstract— We study the effects of structure parameters and band nonparabolicity on the electronic states and the second order optical nonlinearities of an asymmetric rectangular quantum well (ARQW). The asymmetry of the potential can be controlled by changing the structural parameters and this adjustable asymmetry is important for optimizing the second-order optical nonlinearities. We have calculated the electronic states in ARQW within the framework of the envelope function approach. Numerical results for $\text{Al}_x\text{Ga}_{1-x}\text{As}/\text{GaAs}/\text{Al}_y\text{Ga}_{1-y}\text{As}$ quantum well are presented. The results obtained show that the structure parameters such as the asymmetry and width of the quantum well significantly influence the second order optical nonlinearities. Moreover, the effects of the band nonparabolicity on the optical nonlinearities of an ARQW becomes more important especially for small well widths.

Index Terms—Intersubband transitions, nonlinear optics, quantum wells, second-harmonic generation, optical rectification.

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