The nonlinear absorption coefficient of strong electromagnetic waves caused by electrons confined in quantum wires

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Abstract: Analytic expressions for the nonlinear absorption coefficient of a strong electromagnetic wave caused by electrons confined in cylindrical quantum wires are calculated by using the quantum kinetic equation for electrons. The problem is considered for electron-phonon scattering mechanisms (electron-optical phonon scattering and electron-acoustic phonon scattering) in the absence of an external magnetic field and for electron-optical phonon scattering in the presence of an external magnetic field. The dependence of the nonlinear absorption coefficient on the intensity E_0 and the frequency ?? of the external strong electromagnetic wave, the temperature T of the system, the radius of the wires R, and the cyclotron frequency w_e (for the case of the presence of an external magnetic field) is obtained. The analytic expressions are numerically calculated and discussed for GaAs/GaAs Al quantum wires. The results are compared with those for normal bulk semiconductors and quantum wells to show the differences.
Author Keywords: Electron-phonon interaction; Nonlinear absorption; Quantum wires

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