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Excited-state absorption and quantum confined Stark effect in embedded silicon and germanium nanocrystals[1] CEYHUN BULUTAY, Bilkent University — Realistic-sized Si and Ge nanocrystals (NCs) embedded in wide band-gap matrices are studied theoretically using an atomistic pseudopotential Hamiltonian. Based on this electronic structure, first the interband absorption is studied which shows the importance of surface polarization effects that significantly reduce the absorption when included. This reduction is found to increase with decreasing NC size or with increasing permittivity mismatch between the NC core and the host matrix. The intraconduction and intravalence band absorption coefficients are also obtained in the wavelength range from far-infrared to visible region. Next, excited-state absorption at three different optical pump wavelengths, 532 nm, 355 nm and 266 nm are studied for 3- and 4 nm-diameter NCs. This reveals strong absorption windows in the case of holes and a broad spectrum in the case of electrons which can especially be relevant for the discussions on achieving gain in these structures. Finally, the interband absorption of NCs is studied under high DC electric field causing the quantum-confined Stark effect.

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