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Coulomb Enhanced Nonlinear Optical Properties of Strongly Confined Excitons in InAs/GaAs Quantum Dots HANZ RAMIREZ, JEFFERSON FLOREZ, ANGELA CAMACHO, Department of Physics, Universidad de los Andes — Nonlinear optical response in parametric crystals has become widely used in entanglement production; however, low generation rate is an undesirable feature of this technique. Self-assembled quantum dots arrays (QDAs) may be a promising alternative with a larger nonlinear coefficients respect to higher dimensionality systems. Previously, some works have dealt with nonlinear susceptibilities of InAs/GaAs quantum dots, studying intraband transitions of either electrons or holes. The second order susceptibilities found there, are substantially bigger than those in bulk samples, although interband excitations and Coulomb effects were not considered. In this work we study the effects of strong confinement and Coulomb interactions on exciton states in fully 3D axially symmetric QDs. By using partial CI approach, we obtain eigenenergies and envelope eigenfunctions. Second order optical susceptibilities and their dependence on quantum dot size and aspect ratio are calculated. As a main result, we observe a Coulomb related enhancement in the second order optical susceptibilities of exciton transitions as compared to those in bulk, 2D, and even 0D purely intraband systems. This increased nonlinear response suggests interband excited QDAs as efficient entanglement sources.

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