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Theory of Charged Quantum Dot Molecules I.V. PONOMAREV, M. SCHEIBNER, E.A. STINAFF, A.S. BRACKER, M.F. DOTY, M.E. WARE, D. GAMMON, T.L. REINECKE, Naval Research Laboratory, Washington DC, V.L. KORENEV, A.F. Ioffe Physical Technical Institute, St. Petersburg, Russia — Recent optical spectroscopy of excitonic molecules in coupled quantum dots (CQDs) tuned by electric field reveal a richer diversity in spectral line patterns than in their single quantum dot counterparts. We developed a theoretical model that allows us to classify energies and intensities of various PL transitions. In this approach the electric field induced resonance tunneling of the electron and hole states occurs at different biases due to the inherent asymmetry of CQDs. The truncated many-body basis configurations for each molecule are constructed from antisymmetrized products of single-particle states, where the electron occupies only one ground state level in single QD and the hole can occupy two lowest levels of CQD system. The Coulomb interaction between particles is treated with perturbation theory. As a result the observed PL spectral lines can be described with a small number of parameters. The theoretical predictions account well for recent experiments.

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