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Theory of Spin States in Coupled Quantum Dots. ILYA PONOMAREV, MATT DOTY, MICHAEL SCHEIBNER, ALLAN BRACKER, DAN GAMMON, TOM REINECKE, Naval Research Laboratory, Washington DC — The system of vertically coupled self-assembled quantum dots (CQDs) tuned by external electric field is a promising candidate as a basis for coherent optical spin manipulation in quantum information applications and spintronics [1]. We have developed a theoretical model that describes spin states of neutral and charged excitons in CQDs [2]. In this approach the electric field induced resonant 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. The interplay between tunneling, electron-electron, hole-hole and electron-hole exchange interactions splits the states with different spin-projections. The model explains a rich diversity of spectral line patterns in photoluminescence spectra observed in recent experiments. [1] E.A.Stinaff et al., Science 311, 636 (2006). [2] I.V. Ponomarev et al., Phys. Stat. Sol. (b), 243, 3869. (2006)

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