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Theory of coherent population trapping and electromagnetically induced transparency in quantum wells and dots ZACHARY DUTTON, Naval Research Lab — Recently, there has been important experimental progress in quantum coherent phenomena in quantum-wells and dots, opening up possibilities for observations of quantum optical effects previously observed in atomic systems. In particular, coherent population trapping (CPT), electromagnetically-induced transparency (EIT), and slow light can occur in systems with sufficiently long ground state coherence, optically connected to an excited level, forming a Lambda-like system. We find that a quantum well or ensemble of dots, in Voigt geometry and illuminated by a bi-chromatic circularly polarized laser, can exhibit CPT and EIT. In this scheme, the electron spin provides the long lived ground states and a trion excitation acts as the excited level. By including optical and g-factor inhomogenous broadening, dephasing due to nuclear hyperfine interaction, and coupling to the both trion excitations, we derive a compact set of criteria for observations of these effects. We compare with experiments to date and discuss future prospects.

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