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Exchange interaction and the tunneling induced transparency in coupled quantum dots[1] HALYNE BORGES, Universidade Federal de Uberlandia and Ohio University, AUGUSTO ALCALDE, Universidade Federal de Uberlandia, SERGIO ULLOA, Ohio University — Stacked semiconductor quantum dots coupled by tunneling are unique "quantum molecule" where it is possible to create a multilevel structure of excitonic states. This structure allows the investigation of quantum interference processes and their control via electric external fields. In this work, we investigate the optical response of a quantum molecule coherently driven by a polarized laser, considering the splitting in excitonic levels caused by isotropic and anisotropic exchange interactions. In our model we consider interdot transitions mediated by the the hole tunneling between states with the same total spin and, between bright and dark exciton states. Using realistic experimental parameters, we demonstrate that the excitonic states coupled by tunneling exhibit an enriched and controllable optical response. Our results show that through the appropriate control of the external electric field and light polarization, the tunneling coupling establishes an efficient destructive quantum interference path that creates a transparency window in the absorption spectra, whenever states of appropriate symmetry are mixed by the hole tunneling. We explore the relevant parameters space that would allows with the experiments.

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