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Coulomb interaction signatures in self-assembled lateral quantum dot molecules XINRAN ZHOU, University of Delaware, JIHOON LEE, Kwangwoon University, South Korea, GREGORY SALAMO, University of Arkansas, MIQUEL ROYO, JUAN CLIMENTE, Universitat Jaume I, Spain, MATTHEW DOTY, University of Delaware — Lateral quantum dot molecules (LQDMs) consist of at least two closely spaced InGaAs quantum dots arranged along axes perpendicular to the growth direction. Coherent interactions between neighboring QDs can lead to the formation of delocalized states with unique and useful properties. LQDMs provide an opportunity for independent control of both coupling and charge occupancy, and are thus of interest for prototype devices that use the QDs as bit registers. The experimental evidence for the existence of delocalized states and inter-dot tunneling in LQDMs, limited by the large center-to-center distance and weak tunneling strength, has been indirect. We use photoluminescence spectroscopy to investigate the ground state of single LQDMs. We apply a voltage along the growth direction that allows us to control the total charge occupancy of the quantum dot molecule. Using a combination of computational modeling and experimental analysis, we assign the observed discrete spectral lines to specific charge distributions. We explain the dynamic processes that lead to these charge configurations through electrical injection and optical generation. Our systemic analysis provides experimental evidence of inter-dot tunneling of electrons as predicted in previous theoretical work.

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