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Electronic and optical properties of laterally coupled InGaAs quantum dots JIE PENG, GABRIEL BESTER, Max Planck Institute for Solid State Research — We calculate the electronic and optical properties of laterally coupled InGaAs/GaAs quantum dot molecules under lateral electric field using empirical pseudopotentials and configuration interaction. Our model structure is directly taken from recent experiments where an In-poor basin develops below the dots. The coupling of the electron states is significantly enhanced by the presence of the basin, while the holes remain mainly uncoupled. At the proper electric field —between 0 V/cm and 200 V/cm, depending on the dot molecule— the electron states can be tuned to be evenly distributed between both dots, forming bonding and antibonding states. The optical absorption is shown to exhibit two bright transitions, mostly independent of the applied field. In emission, we argue that a fast electron-dynamics must be introduced, since the electrons are not subject to a true potential barrier between the dots and consequently only the lowest of the electron states is occupied. Following this approach, we obtain only one bright peak at high electric fields and two peaks (at higher temperature, four peaks) at the tuning point of the electron states. The results are shown to compare very well with recent experiments. A simple 4x4 Hamiltonian is derived to explain the results in the intuitive dot-localized basis.

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