Vertical Semiconductor Quantum Dot Artificial Molecules

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We investigate the dissociation of few-electron circular vertical semiconductor double quantum dot artificial molecules at 0 T as a function of interdot distance. A slight mismatch unavoidably introduced in the fabrication of the artificial molecules from material with nominally identical constituent quantum wells induces localization by offsetting the energy levels in the two quantum dots by up to 2meV. This plays a crucial role in the appearance of the addition energy spectra as a function of interdot coupling strength particularly in the weak coupling limit. We conclude that our artificial molecules are slightly heteronuclear rather than homonuclear.

We can also study the influence of a magnetic field on the few-electron ground states of an artificial molecule. We focus on an intermediately coupled double dot structure with the magnetic field applied both perpendicular and parallel to the plane of the constituent quantum dot disks. A magnetic field is an ideal tool to manipulate energy levels of quantum dot molecules.