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Mapping hole spin texture in quantum dots and quantum dot molecules[1] XIANGYU MA, Univ of Delaware, GARNETT BRYANT, National Institute of Standards and Technology, MATTHEW DOTY, Univ of Delaware — Holes in semiconductor quantum dots (QD) and quantum dot molecules (QDM) have unique electronic and spin properties that make them a promising candidate for a qubit. To understand the physical origin of these properties and identify promising paths to optimizing these properties for device applications, we use atomistic tight binding theory and a finite basis matrix approximation to compute the contributions to hole spin projections at each atomic site within a QD or QDM. We consider strained InAs/GaAs and strain-free GaAs/AlAs QDs and vertically stacked InAs/GaAs QDMs subject to a variety of applied electric and magnetic fields. For example, in a single GaAs/AlAs QD we observe a strong spin polarization in the z-direction with an applied lateral electric field parallel to a Voigt configuration magnetic field. However, the hole spin remains unpolarized when the lateral electric field is orthogonal to the magnetic field. We use a 3-D model to explore the spin contributions from anion and cation sites, different atomic planes, and separate QDs within a QDM. We suggest possible experiments to validate these computational results.

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