# Fine structure of light-hole excitons in nanowire quantum dots

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Quantum dots with light-hole ground states could find numerous applications including faster quantum bit operations or coherent conversion of photons into electron spins. Typically, however, holes confined in epitaxial quantum dots are of heavy-hole character. I show, by use of atomistic tight-binding theory, that the hole ground state undergoes a transition from heavy holelike to light holelike with increasing height of a nanowire InAs/InP quantum dot [1]. The fine structure of the light-hole exciton consists of a dark ground state and three bright states. Two of the bright states are quasidegenerate and are in-plane polarized, whereas, the third energetically higher bright state is polarized in the perpendicular out-of-plane direction. The light-hole exciton fine structure is robust against alloying.

For comparison, I investigate excitonic energies and fine structure for million-atom heavy-hole ground state InAs/InP quantum dots [2]. I demonstrate that strain effects play an essential role as the main contribution to the bright exciton splitting in InAs/InP quantum dots and observe highly reduced fine-structure splitting for high-symmetry quantum dots. I report the "intrinsic" fine-structure splitting, due to the underlying crystal lattice, to be generally significantly larger [3] than the values predicted by the empirical pseudopotential calculations.

[1] M. Zielinski, *Phys. Rev. B.* **88**, 115424 (2013).
[2] M. Zielinski, J. Phys.: Condens. Matter **25**, 465301 (2013).
[3] M. Zielinski, *Phys. Rev. B.* **88**, 155319 (2013).