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Quantum dots with light-hole exciton ground state BARBARA WITEK, NIKA AKOPIAN, Kavli Institute of Nanoscience, TU Delft, YONGHENG HUO, SANTOSH KUMAR, Institute for Integrative Nanosciences, IFW Dresden, RICARDO CARDENAS, GABRIEL BESTER, Max-Planck-Institute for Solid State Research, Stuttgart, ARMANDO RASTELLI, Institute of Semiconductor and Solid State Physics, Linz, OLIVER SCHMIDT, Institute for Integrative Nanosciences, IFW Dresden, VAL ZWILLER, Kavli Institute of Nanoscience, TU Delft — A light-hole exciton is a quasiparticle formed from a single electron and a single light-hole (LH). This is a fundamental excitation in a semiconductor quantum dot (QD), which could potentially lead to new and simpler schemes in quantum information science and technology, However, it has not been explored so far because the ground state of a hole in a QD has dominant heavy-hole character. Here we develop a novel type of a QD system that allows us to engineer GaAs/ AlGaAs QDs with a light-hole (LH) ground state by embedding them in tensile strained membranes. We fully characterize LH exciton states in polarization resolved μ-photoluminesce in the external magnetic field. LH exciton manifests itself in three orthogonally-polarized bright transitions and a large fine-structure. Further, we determine LH g-factor and observe different diamagnetic coefficients for LH $p_{x,y}$ and p_z orbitals. Finally, we provide a comprehensive theoretical description of all the observed LH exciton properties: fine structure, polarization, oscillator strength and g-factors. Our work paves the way to explore the fundamental properties and potential relevance of LH-excitons in QD for quantum information technologies.

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