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Time-resolved luminescence of hierarchically self-assembled GaAs/AlGaAs quantum dots[1] BOTAO ZHANG, University of Pittsburgh, ARMANDO RASTELLI, OLIVER SCHMIDT, Institute for Integrative Nanosciences, IFW Dresden, Helmholtzstrasse 20, D-01069 Dresden, Germany, JEREMY LEVY, DAVID SNOKE, University of Pittsburgh, ALBERT HEBERLE, Sullivan Park R&D Center, Corning Incorporated and University of Pittsburgh — Hierarchically self-assembled GaAs/AlGaAs quantum dots are promising building blocks for quantum information processing and novel lasers because they combine the tight confinement of InGaAs dots with the size homogeneity and a shorter emission wavelength of the GaAs/AlGaAs system at which many photodetectors are especially sensitive. So far, the emission dynamics of these structures has been unexplored. With a streak camera connected to a confocal microscope, we have measured the luminescence dynamics after direct optical picosecond excitation into the quantum dot states at a sample temperature of 10 K. Ensembles of high-density quantum dots (30 dots/μm^2) with well-separated transitions give information on state filling as well as intra- and interband relaxation. Single quantum dots on low-density samples (0.5 dots/μm^2) with microelectronvolt emission line widths reveal furthermore the time scale of biexciton formation and decay, as well as coherent effects.

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