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Low-threshold few-emitter quantum dot lasing. GLENN SOLOMON, NIST Physics Laboratory, Gaithersburg, MD, WEI FANG, NIST-Physics Laboratory, Gaithersburg, MD, STEPHAN GOETZINGER, Laboratorium fur Physikalische Chemie, ETH Zurich, Zurich Switzerland, ZHIGANG XIE, Stanford University, Stanford CA — Ultra-low threshold lasing via a single emitter is of strong fundamental interest in solid-state and atomic physics. While lasing from a single emitter has not yet been observed in solid-state systems, a quantum dot (QD) gain medium of only a few QD states can be coupled to an optical cavity mode and lase. We describe such an ultra-low threshold lasing system here utilizing a microdisk cavity and a dilute QD gain medium. The microdisk is GaAs and supports high quality-factor whispering gallery modes. The QD gain medium is composed of InAs-based QDs formed epitaxially through lattice mismatch strain. Our systems show lasing even in the smallest, sub-2 micrometer disk diameters. Because of the high cavity quality factor, we observe nondegenerate modes due to broken symmetry. A typical QD spectrum of discrete emission lines observed at lower pump power is often highly modified near transparency leading to pump power dependent absorption. Changes in the cavity linewidth, second-order correlation measurements, and output emission versus input pumping are used to verify lasing. The system has sub-microwatt CW lasing thresholds and exhibits lasing from a small number of emitters.

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