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Phonon Assisted Gain in a Semiconductor Double Quantum Dot Maser MICHAEL GULLANS, National Institute of Standards and Technology, Gaithersburg, MD, Y.-Y. LIU, J. STEHLIK, C. EICHLER, J. R. PETTA, Princeton University, Princeton, NJ, J. M. TAYLOR, National Institute of Standards and Technology, Gaithersburg, MD — We develop a microscopic model for a double quantum dot (DQD) maser. In characterizing the gain of this device we find that, in addition to the direct stimulated emission of photons, there is a large contribution from transitions that involve the simultaneous emission of a photon and a phonon. This phonon assisted process controls the lasing transition because it dominates the gain in the region of large population inversion. These theoretical results are compared to experiment. The broadband nature of this phonon assisted process implies that the maser operation is robust against charge noise and fabrication imperfections. In addition, due to the sharp threshold behavior of the lasing transition, this work indicates that the maser can serve as an extremely sensitive probe of the mesoscopic environment of the DQD.

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