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Photoemission and Masing in a Cavity-Coupled Semiconductor Double Quantum Dot

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Semiconductor circuit QED devices are exciting platforms for studying the coupled dynamics of single charges, photons, and phonons. I will describe a newly discovered maser, which is driven by single electron tunneling events that result in gigahertz frequency photon emission.[1] Semiconductor double quantum dots, sometimes referred to as electrically tunable "artificial molecules," serve as the gain medium and are placed inside of a high quality factor microwave cavity. Maser action is verified by comparing the statistics of the emitted microwave field above and below the maser threshold.[2] Furthermore, by driving the cavity with a seed tone, it is possible to injection lock the maser, greatly reducing the emission linewidth. The frequency range over which the maser can be injection locked closely follows predictions from Adler's equation.[3]

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