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Optimizing order in PECVD quantum dot arrays with applications in quantum information MICHAEL DELANTY, The University of Sydney, KOSTYA OSTRIKOV, CSIRO, IGOR LEVCHENKO, The University of Sydney, STOJAN REBIC, Macquarie University, PLASMA NANOSCIENCE TEAM — Quantum Dot Arrays (QDAs) are of increasing interest in nano-sized technologies due to their highly tunable optical and electronic properties. Spatially ordered, self organized QDAs are highly sought after in many applications such as lasers, solar cells and photo-detectors. However, current self organized fabrication approaches cannot produce high density spatially ordered QDAs, which has resulted in unwanted line broadening in the QDA spectra. Here we show that it is possible to create dense QDAs that are highly ordered using a plasma based technique. The local ordering parameters introduced take into account the highly confined wavefunctions of quantum dots and have wide application in characterizing experimental QDAs. The Plasma Enhanced Chemical Vapor Deposition (PECVD) model used is a multiscale, hybrid numerical simulation that improves upon previous work by including more realistic surface diffusion processes. The most ordered arrays are then used as the basis of a new type of optical quantum CNOT gate. The performance of this gate is assessed and its dependence on spatial order is demonstrated. This work represents a significant step forward in using PECVD for solid state quantum computing.

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