Abstract Submitted
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Multi-Excitonic Quantum Dot Molecules M. SCHEIBNER, E.A. STINAFF, M.F. DOTY, M.E. WARE, A.S. BRACKER, D. GAMMON, I.V. PONOMAREV, T.L. REINECKE, Naval Research Laboratory, Washington DC 20375 USA, V.L. KORENEV, A.F. Ioffe Physical Technical Institute, St. Petersburg 194021 Russia — With the ability to create coupled pairs of quantum dots, the next step towards the realization of semiconductor based quantum information processing devices can be taken. However, so far little knowledge has been gained on these artificial molecules. Our photoluminescence experiments on single InAs/GaAs quantum dot molecules provide the systematics of coupled quantum dots by delineating the spectroscopic features of several key charge configurations in such quantum systems, including X, X^+,X^{2+}, XX, XX^+(with X being the neutral exciton). We extract general rules which determine the formation of molecular states of coupled quantum dots. These include the fact that quantum dot molecules provide the possibility to realize various spin configurations and to switch the electron hole exchange interaction on and off by shifting charges inside the molecule. This knowledge will be valuable in developing implementations for quantum information processing.

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