Controlled Coupling and Occupation of Silicon Atomic Quantum Dots at Room Temperature

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It is demonstrated that the zero-dimensional character of the silicon atom dangling bond (DB) state allows controlled formation and occupation of a new form of quantum dot assemblies - at room temperature. Coulomb repulsion causes DBs separated by less than ~2 nm to experience reduced localized charge. The unoccupied states so created allow a previously unobserved electron tunnel-coupling of DBs, evidenced by a pronounced change in the time-averaged view recorded by scanning tunneling microscopy. It is shown that fabrication geometry determines net electron occupation and tunnel-coupling strength within multi-DB ensembles and moreover that electrostatic separation of degenerate states allows controlled electron occupation within an ensemble.

M. Baseer Haider, M. Baseer Haider, Jason L. Pitters, Gino A. DiLabio, Lucian Livadaru, Josh Y. Mutus and Robert A. Wolkow, "Controlled Coupling and Occupation of Silicon Atomic Quantum Dots at Room Temperature", *Physical Review Letters* **102**, 046805 (2009).