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Study of Charged Exciton in Silicon Quantum Dot. GIAN FRANCO SACCO, PAUL VON ALLMEN, SEUNGWON LEE, Jet Propulsion Laboratory — The trion system, a bound state of two electrons and a hole or two holes and one electron, has received particular attention in the past few years due to the possible practical applications, ranging from single photon emitter which can be used in quantum cryptography, ulta-high density memory devices, mobile light emitters and probe for semiconductor material. Moreover the trion has been proposed as a key element in the fabrication of quantum gates allowing fast spin flip of an electron in a charged quantum dot. In this study we compute the lowest energies of a trion system for two Silicon quantum dots of radius 1.09 and 1.36 nm respectively by using the configuration interaction method. We first obtain the electron and hole energies states using the tight binding method and then we construct a basis set of trion states with good spin quantum number and diagonalize the trion Hamiltonian. We find that the spin three half state is more bound then the one-half and we confirmed that the binding energy decreases as the size of the system increases. We get that the trion binding energy of the dot with radius 1.09 nm is 0.242 eV and 0.227 eV for the spin three-half and one-half respectively, while that of the dot with radius 1.36 nm is 0.295 eV for the spin three-half state and 0.261 eV for the spin one half-state.

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