Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

A molecular orbital study of the energy spectrum, exchange interaction and gate crosstalk of a four-quantum-dot system[1] XU-CHEN YANG, XIN WANG, City Univ of Hong Kong — The manipulation of coupled quantum dot devices is crucial to scalable, fault-tolerant quantum computation. We present a theoretical study of a four-electron four-quantum-dot system based on molecular orbital methods, which depicts a pair of singlet-triplet (S-T) qubits. We find that while the two S-T qubits are coupled by the capacitive interaction when they are sufficiently far away, the admixture of wave functions undergoes a substantial change as the two S-T qubits get closer. We find that in certain parameter regime the exchange interaction may only be defined in the sense of an effective one when the computational basis states no longer dominate the eigenstates. We further discuss the gate crosstalk as a consequence of this wave function mixing.

[1]This work was supported by the Research Grants Council of the Hong Kong Special Administrative Region, China (No. CityU 21300116) and the National Natural Science Foundation of China (No. 11604277).

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Date submitted: 09 Nov 2016 Electronic form version 1.4