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A fast "hybrid" silicon double quantum dot qubit[1]

TECK SENG KOH, ZHAN SHI, C.B. SIMMONS, J.R. PRANCE, JOHN KING GAMBLE, YUN-PIL SHIM, University of Wisconsin-Madison, XUEDONG HU, University at Buffalo, SUNY, D.E. SAVAGE, M.G. LAGALLY, M.A. ERIKSSON, MARK FRIESEN, S.N. COPPERSMITH, University of Wisconsin-Madison — We propose a quantum dot qubit architecture that has an attractive combination of speed and fabrication simplicity. It consists of a double quantum dot with one electron in one dot and two electrons in the other. The qubit itself is a set of two states with total spin quantum numbers $S^2 = 3/4$ (S = 1/2) and S_z = -1/2, with the two different states being singlet and triplet in the doubly occupied dot. The architecture is relatively simple to fabricate, a universal set of fast operations can be implemented electrically, and the system has potentially long decoherence times. These are all extremely attractive properties for use in quantum information processing devices.

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Teck Seng Koh
tkoh2@wisc.edu
University of Wisconsin-Madison

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