Abstract Submitted
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Valley splitting in low-density quantum-confined heterostructures: Superposition, not Spin![1] TIMOTHY BOYKIN, Univ. Alabama in Huntsville, GERHARD KLIMECK, Purdue University, S. COPPERSMITH, MARK FRIESEN, Univ. Wisconsin, PAUL VON ALLMEN, SEUNGWON LEE, FABIANO OYAFUSO, Jet Propulsion Laboratory — Although valley splitting in Si quantum-confined heterostructures has been studied for many years, it is far less well understood than one might expect. Because valley degeneracy is problematic in spin quantum computing as a potential source of decoherence and other difficulties it is essential that its origins be thoroughly explained. We explain the valley splitting in Si quantum wells using a simple tight-binding model which eliminates the artificial valley coupling constants found in multiband/multi-valley effective mass treatments. The results of the simple tight-binding model agree well with multiband tight-binding results, and explain the changing parity of the ground state, and the behavior of the splitting as a function of well width. The results show that the valley splitting has nothing to do with spin, but is instead purely due to the superposition of states in the quantum well.

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