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Multi-valley effective mass treatment of donor-dot tunneling in silicon ADAM FREES, UW-Madison, ANDREW D. BACZEWSKI, JOHN KING GAMBLE, N. TOBIAS JACOBSON, RICHARD P. MULLER, ERIK NIELSEN, Sandia National Laboratories — Many cutting-edge experiments in silicon-based devices for quantum information processing involve the tunneling of an individual electron from a donor atom within the material to the interface of the heterostructure. Understanding how this tunneling process varies among different realistic devices is therefore of great interest. Using a multi-valley effective mass approximation method, we find the tunnel coupling, adiabatic min-gap, and ionizing electric field strength between a phosphorous donor in silicon and a nearby quantum dot at a Si/SiO_2 interface. Additionally, we calculate these quantities for a phosphorous donor in strained silicon and a Si/SiGe interface. We consider how these properties change as a function of relative position between the donor and the dot. The authors gratefully acknowledge support from the Sandia National Laboratories Truman Fellowship Program, which is funded by the Laboratory Directed Research and Development (LDRD) Program. Sandia is a multi-program laboratory managed and operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation, for the US Department of Energy's National Nuclear Security Administration under Contract No. DE-AC04-94AL85000.

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