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Physical mechanisms of interface-mediated intervalley coupling in Si

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The conduction band degeneracy in Si is detrimental to quantum computing based on spin qubits, for which a nondegenerate ground orbital state is desirable. This degeneracy is lifted at an interface with an insulator as the spatially abrupt change in the conduction band minimum leads to intervalley scattering. We present a theoretical study of the interface-induced valley splitting in Si that provides simple criteria for optimal fabrication parameters to maximize this splitting. Our work emphasizes the relevance of different interface-related properties to the valley splitting.

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