

## Derivation of effective spin-orbit Hamiltonians and spin lifetimes<sup>†</sup>

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A general approach is derived for constructing an effective spin-orbit Hamiltonian for nonmagnetic materials, which is useful for calculating spin-dependent properties near an arbitrary point in momentum space with pseudospin degeneracy. The formalism is verified through comparisons with other approaches for III-V semiconductors, and its general applicability is illustrated by deriving the spin-orbit interaction and predicting spin lifetimes for strained SrTiO<sub>3</sub> and a two-dimensional electron gas in SrTiO<sub>3</sub> (such as at the LaAlO<sub>3</sub>/SrTiO<sub>3</sub> interface). These results suggest robust spin coherence and spin transport properties in SrTiO<sub>3</sub>-based materials at room temperature.

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