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Effective spin-orbit Hamiltonians and spin lifetimes for diamond and strontium titanate CUNEYT SAHIN, Optical Science and Technology Center and Department of Physics and Astronomy, University of Iowa, Iowa City, Iowa 52242, USA, GIOVANNI VIGNALE, Department of Physics and Astronomy, University of Missouri, Columbia, Missouri 65211, USA, MICHAEL E. FLATTÉ, Optical Science and Technology Center and Department of Physics and Astronomy, University of Iowa, Iowa City, Iowa 52242, USA — The long spin coherence times of spin centers in diamond and the large Rashba coefficients and spin injection efficiencies in strontium titanate-based two-dimensional systems makes these wide band-gap semiconductors strong candidates for spintronics applications. To calculate the spin properties of these inversion-symmetric materials we have constructed a low-energy Hamiltonian, making use of a tight-binding model with atomic spin-orbit interactions. Furthermore we have derived and calculated the tensor that controls the form of the effective spin-orbit interaction in the non-spherical conduction bands of these materials. Finally we have computed the spin relaxation rates via the Elliott-Yafet mechanism through impurity scattering for diamond and uniaxially strained strontium titanate as a function of temperature and carrier density. Long spin lifetimes suggest the potential for novel spintronic applications of these wide bandgap semiconductors. This work was supported by an ARO MURI and an AFOSR MURI.

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