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Electron spin flips due to scattering off substitutional donors in multivalley semiconductors[1] YANG SONG, Department of Electrical and Computer Engineering, University of Rochester, Rochester, New York, 14627, OLEG CHALAEV, Department of Electrical and Computer Engineering, University of Rochester, HANAN DERY, Department of Electrical and Computer Engineering, Department of Physics and Astronomy, University of Rochester — We elucidate the physical origin of donor-driven spin relaxation in multivalley semiconductors with an emphasis on silicon. This spin flip is dominated by intervalley scattering between non time-reversal related valleys and by spin-orbit interaction from the core region of the donors. By a concise and intuitive explanation, we will present how the crystal symmetries and the multivalley nature of the conduction band set the selection rules for spin flip transitions, and how to decisively associate the microscopic contributions with the empirically found strong dependence of the spin relaxation on the donor identity. These analyses and results are quite general for various other materials with multivalley conduction bands, and they are crucial for optimizing spintronics devices especially in the highly doped region near semiconductor-ferromagnet interfaces.

[1] Yang Song, Oleg Chalaev and Hanan Dery, Phys. Rev. Lett., 113, 167201 (2014).

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