

Abstract Submitted  
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**Decrease of electron spin lifetime in external electric field due to intervalley phonon scattering in silicon**<sup>1</sup> LAN QING, HANAN DERY, University of Rochester, Rochester, New York 14627, JING LI, IAN APPELBAUM, University of Maryland, College Park, Maryland 20742 — We derive a simple approximate expression of the spin lifetime of drifting electrons in silicon. This expression agrees well with elaborate Monte Carlo simulations of the charge transport and spin relaxation of conduction electrons heated by the electric field. Already at low temperatures, the drifting electrons become hot enough to undergo *f*-processes (scattering between valleys of different crystal axes following emission of a shortwave phonon). Such a process involves a direct coupling of valence and conduction bands and dominates the spin relaxation. A sharp decrease of spin lifetime can then be expected in intermediate electric fields in between  $\sim 100$  V/cm and  $\sim 1$  kV/cm. When electrons are transported between a spin injector and a spin-resolved detector, the decrease of both transit time and spin lifetime results in a non-monotonic behavior of the detected spin polarization with the electric field. The theory shows excellent agreement with empirical results.

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