

Modeling Silicon Spintronics

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Abstract-Silicon, the main material of microelectronics, is perfectly suited for spin-driven applications. All-electrical spin injection in silicon has been demonstrated, however, the magnitude of the corresponding signal is larger than theoretically predicted. We analyze the influence of electrostatic charge screening on the efficiency of spin injection at the ferromagnet-semiconductor interface. We show that the spin-injection efficiency cannot exceed the value obtained at the charge neutrality condition. Finally, we demonstrate that a large enhancement of the electron spin lifetime in silicon thin films can be obtained by applying shear strain, which is routinely used to boost the electron mobility in MOSFETs.

Keywords-Spin injection modeling, spin lifetime modeling, valley splitting modeling