Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Mobility and spin lifetime enhancement in thin silicon films by shear strain[1] DMITRI OSINTSEV, VIKTOR SVERDLOV, SIEGFRIED SELBERHERR, Institute for Microelectronics, TU Wien — We investigate numerically the spin lifetime and mobility enhancement in (001) silicon films. Surface roughness and electron-phonon scattering is taken into account. To find the wave functions and scattering matrix elements we use the $\mathbf{k} \cdot \mathbf{p}$ Hamiltonian with spin-orbit interaction for the relevant [001] valleys [1]. Knowing the wave functions at the center of the two-dimensional Brillouin zone is sufficient for mobility calculations. When shear strain increases the [110] mobility is enhanced due to the transport mass lowering and the usually ignored wave functions' dependence and the corresponding matrix elements' reduction. For spin relaxation calculations the in-plane momentum dependence of the subband wave functions due to spin-orbit coupling responsible for spin admixture must be preserved. This significantly increases demands for computational resources and requires extensive code parallelization. The spin lifetime is mostly determined by the spin-flip processes between the opposite [001] valleys strongly coupled by the effective spin-orbit interaction. Shear strain mitigates this coupling by lifting the valley degeneracy. This results in a strong increase of the spin lifetime with shear strain.1.P.Li and H.Dery, *Phys.Rev.Lett.***107**, 107203 (2011).

[1]This work is supported by the European Research Council through the grant #247056 MOSILSPIN

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Date submitted: 14 Nov 2013 Electronic form version 1.4