Abstract Submitted
for the MAR07 Meeting of
The American Physical Society

Spin precession and spin relaxation in semiconductors DIMITRIE CULCER, ROLAND WINKLER, Advanced Photon Source, Argonne National Laboratory, Argonne IL 60439, and Northern Illinois University, De Kalb IL 60115 —
In order to achieve a lasting spin polarization a proper understanding of the mechanisms leading to spin polarization decay is critical. We present a general theory for spin polarization decay due to the interplay of spin precession and momentum scattering that is applicable to both spin-1/2 electrons and spin-3/2 holes and that allows us to identify and characterize a wide range of qualitatively different regimes [1]. The spin polarization of ballistic carriers is reduced by spin dephasing, which is characterized by a non-exponential time dependence and results in an incomplete decay of the spin polarization. For weak momentum scattering or fast spin precession, the spin relaxation time is proportional to the momentum relaxation time. For strong momentum scattering and slow spin precession we recover the D'yakonov-Perel result that the spin relaxation time is inversely proportional to the momentum relaxation time.

[1] D. Culcer and R. Winkler, cond-mat/0610779.

Dimitrie Culcer
Advanced Photon Source, Argonne National Laboratory, Argonne IL 60439
and Northern Illinois University, De Kalb IL 60115

Date submitted: 17 Nov 2006 Electronic form version 1.4