Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Spin Relaxation in III-V Semiconductors in various systems: Contribution of Electron-Electron Interaction FATIH DOGAN, HASAN KESSERWAN, AURELIEN MANCHON, King Abdullah University of Science and Technology (KAUST) — In spintronics, most of the phenomena that we are interested happen at very fast time scales and are rich in structure in time domain. Our understanding, on the other hand, is mostly based on energy domain calculations. Many of the theoretical tools use approximations and simplifications that can be perceived as oversimplifications. We compare the structure, material, carrier density and temperature dependence of spin relaxation time in n-doped III-V semiconductors using Elliot-Yafet (EY) and D'yakanov-Perel'(DP) with real time analysis using kinetic spin Bloch equations (KSBE). The EY and DP theories fail to capture details as the system investigated is varied. KSBE, on the other hand, incorporates all relaxation sources as well as electron-electron interaction which modifies the spin relaxation time in a non-linear way. Since el-el interaction is very fast ($\sim$ fs) and spin-conserving, it is usually ignored in the analysis of spin relaxation. Our results indicate that electron-electron interaction cannot be neglected and its interplay with the other (spin and momentum) relaxation mechanisms (electron-impurity and electron-phonon scattering) dramatically alters the resulting spin dynamics. We use each interaction explicitly to investigate how, in the presence of others, each relaxation source behaves. We use GaAs and GaN for zinc-blend structure, and GaN and AlN for the wurtzite structure.

Fatih Dogan
King Abdullah University of Science and Technology

Date submitted: 15 Nov 2014 Electronic form version 1.4