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Spin lifetimes in InGaAs quantum wells[1] YU-TSUNG TSAI, ANDREAS RUSS, THOMAS SCRACE, ATHOS PETROU, SUNY at Buffalo, Buffalo, NY, PINGYUE SONG, HANAN DERY, University of Rochester, Rochester, NY, GEORGE KIOSEOGLOU, University of Crete, Heraclion, Greece, CONNIE LI, BEREND JONKER, Naval Research Laboratory, Washington DC — We have carried out Hanle spin relaxation time measurements in InGaAs quantum well structures as well as in Fe-based spin-LEDs that incorporate InGaAs QWs. In the InGaAs QW structures the spin lifetime T_S at T = 5 K is equal to 2 ns while in spin LEDs T_S is only 0.17 ns. For the undoped QWs, T_S increases from 2ns at 5K to 4.5ns at 15K and then decreases monotonically. On the other hand, T_S in the LEDs increases monotonically with temperature. The origin for the difference in the spin lifetimes between undoped QWs and that within a LED structure can be understood by considering the corresponding differences in the band structure between the symmetric quantum well and the spin-LED. In the latter, the Rashba spin-orbit interaction due to the built-in asymmetry brings about a significant enhancement in spin relaxation. In addition, bias conditions in the spin-LED play a crucial role in determining the temperature trend of the spin relaxation. The bias voltage tunes the electron density and accordingly the spin dephasing could be either suppressed or enhanced by electron-electron scattering.

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