“Listening” to the Spin Noise of Conduction Electrons in Semiconductors

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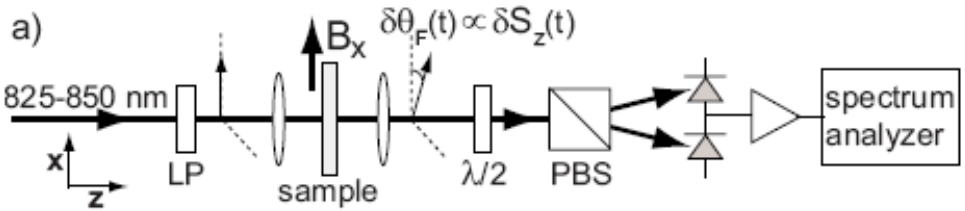
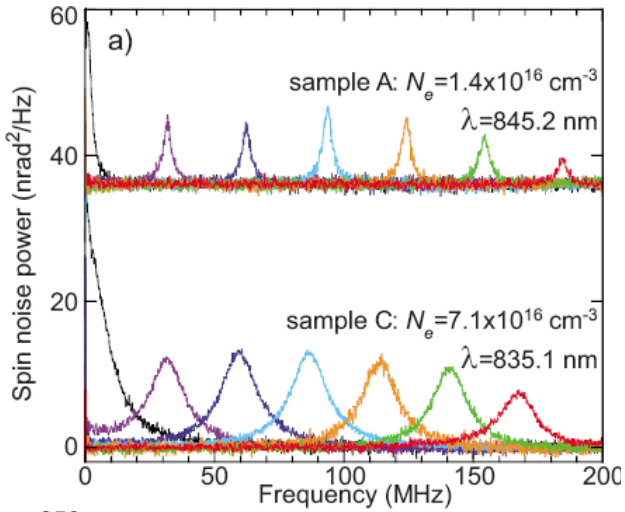
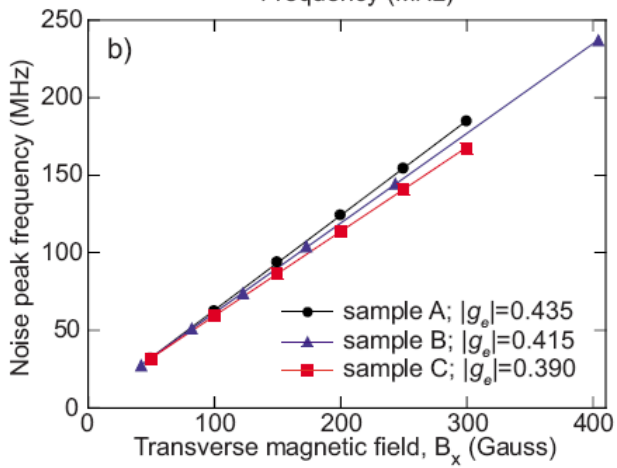
- In electron-doped (*n*-type) bulk GaAs, we measure the intrinsic, random fluctuations of electron spins – “spin noise” -- using an ultra-sensitive optical magnetometer based on Faraday rotation.



- Simply by “listening” to the spin fluctuations alone, we determine important dynamical spin properties (such as spin lifetimes & Lande g-factors) *without* ever perturbing the spin system from thermal equilibrium -- in marked contrast to conventional magnetic resonance methods.

- The plot to the right shows the “extra” noise peaks coming from the randomly fluctuating (& precessing) electron spins in the unperturbed Fermi sea in the conduction band of *n*:GaAs (for transverse fields of 0, 5, 10, 15, 20, 25, 30 mT). The position gives the g-factor; the width gives the spin lifetime.