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Frequency-domain optical probing of coherent spins in semiconductors JESSE BEREZOVSKY, JOHNATHON FREY, Case Western Reserve University — We have demonstrated a technique for measuring GHz-scale coherent spin dynamics in semiconductors using narrow-linewidth modulated lasers. This scheme, based on the Faraday effect, is carried out by adding a sinusoidal modulation at frequency Ω to continuous-wave pump and probe lasers. The result is to effectively shift the Fourier component of the Faraday rotation signal at Ω to zero frequency, where it can be measured by a low-bandwidth detector. By producing the Fourier transform of the time-domain spin dynamics, this method yields the same information as pulsed pump-probe measurements without the need for complex pulsed lasers, and with minimal spectral bandwidth, allowing for high-resolution spectroscopic measurements. The ability to perform Faraday rotation measurements with narrow-linewidth lasers is essential for observing spins in individual quantum dots, or for avoiding unintentional carrier excitation. We have employed this technique to observe coherent spin dynamics in CdSe nanocrystals using standard diode lasers. By fitting these results to the expected model, we can extract electron g-factors, and spin coherence and dephasing times in agreement with time-domain measurements.

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