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Magnetic force detection of non-equilibrium electron spin-polarization in n-GaAs VIDYA BHALLAMUDI, GANG XIANG, Dept of Physics, Ohio State University, Columbus, OH 43210, MARK BRENNER, Dept of Electric and Computer Engineering, Ohio State University, Columbus, OH 43210, YOUNGWOO JUNG, YURI OBUKHOV, DENIS PELEKHOV, Dept of Physics, Ohio State University, Columbus, OH 43210, STEVE RINGEL, Dept of Electric and Computer Engineering, Ohio State University, Columbus, OH 43210, P. CHRIS HAMMEL, Dept of Physics, Ohio State University, Columbus, OH 43210 — Magnetic Force Microscope (MFM) offers an alternative to optical and electrical techniques for detecting and imaging spin-polarized electron populations in semiconductor spintronic devices. Unlike other methods, MFM has the advantage of being material non-specific as it directly detects spins in the semiconductor through their magnetic dipole coupling to micromagnetic tip. However, it is challenging to achieve the high sensitivity required for sensing small non-equilibrium spin populations, orders of magnitude smaller than those in ferromagnetic materials. Here we present our progress developing a high sensitivity cryogenic MFM for imaging optically injected electronic spins in GaAs. Spins are created in an epitaxially grown n-GaAs membrane by circularly polarized laser shone from an optical fiber. A cantilever scans over the membrane and detects the magnetic force due to the optically injected spins. Micro-magnetic tip generating large field gradient is used for enhancing the signal. We will show simulation results for the expected forces, taking spin relaxation, diffusion and local tip field into account. The status of spin imaging experiment will also be presented.

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