Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

Improving the Collection Efficiency of Bulk Diamond NV Center Fluorescence with Solid Immersion Lenses[1] T.O. BRUNDAGE, S. SANGTAWESIN, J.R. PETTA, Department of Physics, Princeton University — The spin-dependent fluorescence of nitrogen vacancy (NV) centers in diamond makes them promising systems for a variety of applications ranging from magnetic field sensing to quantum information processing. The fidelity of optical detection of NV center spin states is therefore dependent on the collection efficiency of the NV fluorescence. While the crystal structure of diamond is useful in allowing for stable, room temperature measurements, its high index of refraction leads to a shallow critical angle of total internal reflection ($\sim 24^\circ$) significantly limiting the optical collection efficiency. Here we develop a method for fabricating a solid immersion lens (SIL) on the surface of bulk diamonds. The hemispherical SILs, milled with high-energy gallium ions, are positioned such that the NV center of interest is at the origin of the sphere, thereby utilizing the full numerical aperture of the objective lens in the confocal microscope. Our lenses have already improved the collection efficiency by a factor of 2-3. With simple first order corrections to the milling process, higher collection efficiencies should be attainable. Further improvements in the lenses will allow single-shot readout of the spin states of NV centers.

[1]Supported by the Sloan and Packard Foundations and the National Science Foundation through the Princeton Center for Complex Materials.

T. O. Brundage
Department of Physics, Princeton University

Date submitted: 27 Dec 2012 Electronic form version 1.4