Nitrogen Vacancy Optically-Detected Magnetometry for Characterization of Systematic Effects in Precision Ultracold Neutron Experiments

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A magnetometer with large dynamic range is potentially useful in the UCNτ experiment at Los Alamos National Laboratory for magnetic field mapping, needed to constrain experimental systematics. Nitrogen Vacancy (NV) centers in a diamond lattice provide a possibility for one such system. The simplest approach is based on an optically-detected magnetic resonance (ODMR) effect. A green laser is beamed into the diamond, causing NV centers to fluoresce and emit red light. In the presence of ~3 GHz microwaves, the emitted red light intensity will sharply decrease at several frequencies corresponding to a zero field splitting and a Zeeman shift in the NV quantum system, the latter of which is dependent on the magnetic field. By determining the frequency of these resonances, the magnetic field can be determined. An NV center-based magnetometer using ODMR was constructed and tested to characterize its sensitivity over a range of field values from μT to T, which includes the characteristic range of magnetic fields important for UCNτ. Data were taken in a Halbach field identical to the one used in UCNτ. Results will be presented describing the performance of this magnetometer.