Exploring Nitrogen–Vacancy Magnetometry

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The UCNτ experiment aims to improve current measurements of the mean free neutron lifetime. One innovation of UCNτ is that a large-volume magneto-gravitational trap is used to prevent polarized ultracold neutrons (UCN) from interacting with the walls of the trap, which prevents them from being lost to material interactions. Thus, the UCNτ experiment can more accurately count neutrons lost specifically to beta decay. Small defects in the magnetic field can still cause losses of UCN stored in the trap, so it is important to be able to detect these defects and account for them. The automated Hall probe currently in use has limited resolution and requires long periods of time to measure magnetic field gradients in the large area of the trap. A possible improvement would be a Nitrogen-Vacancy (NV) fluorescence microscopy setup which could increase the spatial resolution at which field data can be collected and increase the speed of data collection. Construction and evaluation of a typical NV magnetometer will be discussed.