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Magnetometry based on a levitated ferromagnetic particle TAO WANG, METIN KAYCI, SEAN O KELLEY, University of California, Berkeley, DEREK KIMBALL, California State University, East Bay, SEAN LOURETTE, University of California, Berkeley, ALEXANDER SUSHKOV, Boston University, ALEXANDER WILZEWSKI, Helmholtz Institute Mainz, Johannes Gutenberg University, DMITRY BUDKER, Helmholtz Institute Mainz UC Berkeley, UC BERKELEY TEAM, CALIFORNIA STATE UNIVERSITY, EAST BAY TEAM, BOSTON UNIVERSITY TEAM, HELMHOLTZ INSTITUTE MAINZ TEAM — A magnetometer based on a magnetized ferromagnetic micro-particle levitated over a superconductor is demonstrated. The particle is placed inside a well in the superconductor; when the superconductor is cooled below the critical temperature with liquid helium, the particle is levitated as a consequence of the Meissner effect. The levitated particle is isolated from molecular collisions at the cryogenic temperatures and partially shielded from external magnetic fields because the superconductor used for levitation acts as magnetic shield which is free of Johnson noise, with a shielding factor better than 5×10^6. When external magnetic field is applied to the system, the particle only feels a small residual field determined by the geometry of the experiment. The motion of the particle is recorded with a camera. The residual magnetic field is determined by measuring the frequencies of the particles motion. Such a magnetometer may be useful for measurement of, for example, exotic spin-dependent interactions of electrons.

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