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An all-optical vector atomic magnetometer for fundamental physics applications DAVID WURM, Excellence Cluster "Universe," Technische Universität München, Garching, Germany, IGNACIO MATEOS, Instituto de Ciències del Espacio (CSIC-IEEC), Barcelona, Spain, ELENA ZHIVUN, BRIAN PATTON, Department of Physics, University of California, Berkeley, California, PETER FIERLINGER, Excellence Cluster "Universe," Technische Universität München, Garching, Germany, DOUGLAS BECK, Department of Physics, University of Illinois at Urbana-Champaign, Urbana, Illinois, DMITRY BUDKER, Department of Physics, University of California, Berkeley, Lawrence Berkeley National Laboratory and Helmholtz Institute, JGU, Mainz, Germany — We have developed a laboratory prototype of a compact all-optical vector magnetometer. Due to their high precision and absolute accuracy, atomic magnetometers are crucial sensors in fundamental physics experiments which require extremely stable magnetic fields (e.g., neutron EDM searches). This all-optical sensor will allow high-resolution measurements of the magnitude and direction of a magnetic field without perturbing the magnetic environment. Moreover, its absolute accuracy makes it calibration-free, an advantage in space applications (e.g., space-based gravitational-wave detection). Magnetometry in precision experiments or space applications also demands long-term stability and well-understood noise characteristics at frequencies below 10^{-4} Hz. We have characterized the low-frequency noise floor of this sensor and will discuss methods to improve its long-time performance.

David Wurm
Excellence Cluster "Universe," Technische Universität München

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