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All-optical vector atomic magnetometer ELENA ZHIVUN, BRIAN PATTON, Department of Physics, UC Berkeley, CHRIS HOVDE, Southwest Sciences, Inc., DMITRY BUDKER, Department of Physics, UC Berkeley — Alkali-vapor magnetometers are among the most precise magnetic sensors today, reaching sensitivities on the scale of $\mathrm{fT}/\sqrt{\mathrm{Hz}}$. In general, alkali-vapor magnetometers operating in finite fields can only measure the scalar magnitude of the field (not its direction or projection). In this work we demonstrate an all-optical *vector* cesium magnetometer with $0.2\,\mathrm{pT}/\sqrt{\mathrm{Hz}}$ sensitivity to the field magnitude and $4\,\mathrm{mrad}/\sqrt{\mathrm{Hz}}$ angular precision in the field direction. Although this can be accomplished by applying orthogonal magnetic fields to the sensor and measuring the change in Larmor frequency, in our sensor we employ the vector light shift induced by orthogonal laser beams to achieve the same effect. We will present results from such a sensor operating in a 10 mG magnetic field and discuss its applications to fundamental physics experiments and remote magnetometry.

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