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Vectorial atomic magnetometer using electronic and nuclear[1]
BINQUAN ZHOU, LINLIN CHEN, GUANQUN LEI, XIAOFENG MENG, JIANCHENG FANG, BeiHang University — We present an experimental study of a vectorial atomic magnetometer, which can measure three-dimensional magnetic field simultaneously. The experimental setup for magnetometer has been described in the literature [1]. Where an external magnetic field is added parallel to the pumping light, that the goal is to switch the nuclear spin state form an undesired state to the desired state creating a gas whose atoms are completely aligned. A probe light is added perpendicular to the pumping light. When there is transverse alternating magnetic field, the probe light will be modulated by the spin procession. We obtain the two transverse magnetic fields signal through the in-phase and out-of-phase of a lock-in amplifier, At the same time, the external magnetic field held constant relative to the external frequency reference, two nuclear signals can be used to measure z vertical magnetic field by comparing the measured two nuclear signal to a second stable reference signal generated by the same external frequency. Once the output signal is feedbacked to the coil, the external three-dimensional magnetic field is measured in real-time. The dynamic range can be adjusted through the external magnetic field,so this method can be used both in the magnetic surveys and in the prospecting field range.

[1] Orang Alem and Karen L. Sauer and M. V. Romalis. Phys. Rev. A 87, 013413 (2013).

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