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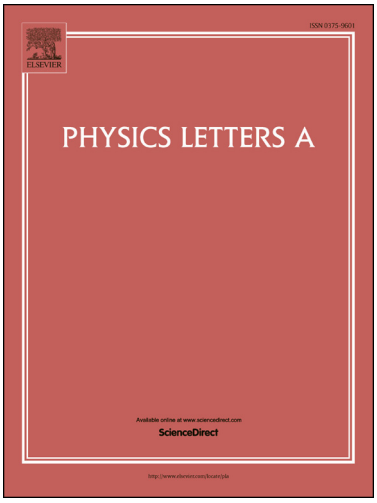

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Cavity-enhanced room-temperature high sensitivity optical Faraday magnetometry

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Abstract

We propose a cavity QED system with two-photon Doppler-free configuration for weak magnetic field detection with high sensitivity at room temperature based on cavity electromagnetically induced transparency. Owing to the destructive interference induced by the control and driving fields, two transparency channels are opened. The Faraday rotation within two transparency channels can be used to detect weak magnetic field with high sensitivity at room temperature. The sensitivity with single photon and multiphoton probe inputs are analyzed. With single photon measurement, our numerical calculations demonstrate that the sensitivity with 3.8 nT/$\sqrt{\text{Hz}}$ and 6.4 nT/$\sqrt{\text{Hz}}$ could be achieved. When we measure the magnetic field with multiphoton input, the sensitivity can be improved into 7.7 fT/$\sqrt{\text{Hz}}$ and 25.6 fT/$\sqrt{\text{Hz}}$ under the realistic experimental conditions.

Keywords: Optical magnetometry, Faraday effect, Cavity QED, Cavity electromagnetically induced transparency

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