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A Sensitive Dead-Zone-Free FID Magnetometer

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Detection dead-zones are important systematic effects in scalar atomic magnetometers, which limit their practical applications. In this work, we demonstrate a sensitive dead-zone-free scalar magnetometer by applying previously developed techniques in a FID magnetometer [1,2]. The detection dead zones are eliminated by adding a reflecting mirror in the middle of a multipass-cavity-assisted cell which bends beam paths inside the cell. Preliminary measurement results show that the change of SNR is two times worse than theoretical estimation, which predicts that sensor signal-to-noise ratio (SNR) is limited within in 50% over sensor orientations in the three dimensional space. However, this still leads to a field sensitivity better than 150 fT/Hz1/2 for any sensor orientation. This work paves the way for a vector FID magnetometer. In this talk, we will present detailed measurement results and the development of a vector magnetometer based on such a sensor.

[1] Q.-Q. Yu, S.-Q. Liu, C.-Q. Yuan, and D. Sheng, Physical Review Applied 18, 014015 (2022)
[2] S.-Q. Liu, X.-K. Wang, X.-D. Zhang, W. Xiao, and D. Sheng, Physical Review A 111, 023119 (2025)

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