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In-situ residual magnetic compensation for zero-field NMOR atomic magnetometer

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Recent decades have witnessed considerable interest in nonlinear magneto-optical rotation (NMOR) atomic magnetometer, which has demonstrated high sensitivity and low error in both near-zero field and geomagnetic environments [1,2]. However, the presence of residual magnetic field in magnetically shielded devices often damages the performance of zero-field NMOR atomic magnetometer [1].

In this study, considering the presence of the residual magnetic field, we develop the response model of zero-field NMOR atomic magnetometer and analyze the effect of triaxial residual magnetic fields on magnetometer. Then a triaxial in-situ residual magnetic field compensation method based on sinusoidal magnetic field modulation is proposed, which is shown as Fig. 1(a). The sensitivity of magnetic field measurement after residual magnetic field compensation is $19 \text{ fT/Hz}^{1/2}$, reflecting a 56% improvement over the uncompensated case. In addition, the noise affecting the sensitivity of the magnetometer is evaluated, shown as Fig. 1(b). The sensitivity after residual magnetic compensation is close to the detecting background noise, which is $14 \text{ fT/Hz}^{1/2}$. This method is of significance for the construction of zero magnetic environment and detection of weak magnetic field in human body.

Figure 1: (a) Residual magnetic compensation method based on sinusoidal magnetic field modulation (b) Sensitivity and noise assessment

References

- [1] D. Budker, V. Yashchuk, M. Zolotarev, Phys. Rev. Lett., 81, 5788 (1998).
- [2] Acosta V., Ledbetter M. P., Rochester S. M., et al, Phys. Rev. A, 73, 053404 (2006).

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