Performance of Integrated ferrite shield in a K-Rb-^{21}Ne co-magnetometer

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Spin-exchange relaxation-free (SERF) co-magnetometer is considered as a promising inertial sensor due to its ultrahigh sensitivity [1]. The environment with zero magnetic field and stable magnetic field is one of the main factors to achieve ultrahigh sensitivity detection. In general, the ferrite shield is used as the internal shield of the co-magnetometer because of its high magnetic and electrical conductivity [2]. However, the large size ferrite shield is composed of ferrite annulus, which affects the performance of magnetic shielding. Therefore, the size of the ferrite is reduced to an inner diameter of 60 mm and a height of 99 mm. It is processed by an integrated process. The magnetic noise of integrated ferrite was measured by SERF atomic magnetometer. As shown in Fig.1, the magnetic noise at the center of the ferrite reaches 6.7 fT/Hz$^{1/2}$, and the detection noise is 2.2 fT/Hz$^{1/2}$. The inertial sensitivity of 7.3 °/s/Hz$^{1/2}$ and the detection system sensitivity of 3.4 °/s/Hz$^{1/2}$ were obtained by integrated testing in K-Rb-^{21}Ne co-magnetometer. The experimental results show that the integrated ferrite can provide a relatively stable magnetic field environment, which is the better choice for the shielding system of the co-magnetometer.

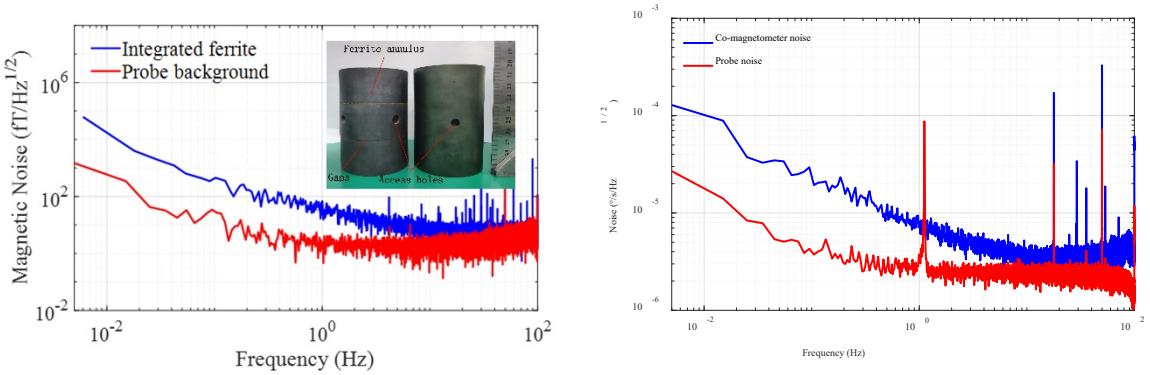

Figure 1. **left:** Integrated ferrite magnetic noise and detection noise measured using SERF magnetometer. **right:** The inertial sensitivity and detection system sensitivity of the co-magnetometer.

References

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