A non-modulated magnetic field compensation method for SERF magnetometer based on zero-field resonance

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This work demonstrates a non-modulated magnetic field compensation method for spin exchange relaxation free (SERF) atomic magnetometers. The alkali atoms are polarized along the z axis, the probe light is along the x axis, and an excitation magnetic field is applied along the y axis to obtain the zero-field resonance signal [1]. The first order differential value of the zero-field resonance reaches to its maximum when the total magnetic field is zero. The x- and z-field components are compensated simultaneously using only one criterion to reduce the cross-talk effect. Then the y-field component is compensated by zeroing the DC response of the magnetometer. This method needs no additional lock-in amplifier for modulation and provides a compensation precision of 9pT, 7pT and 0.05pT for x-, z-, and y-axis respectively. .

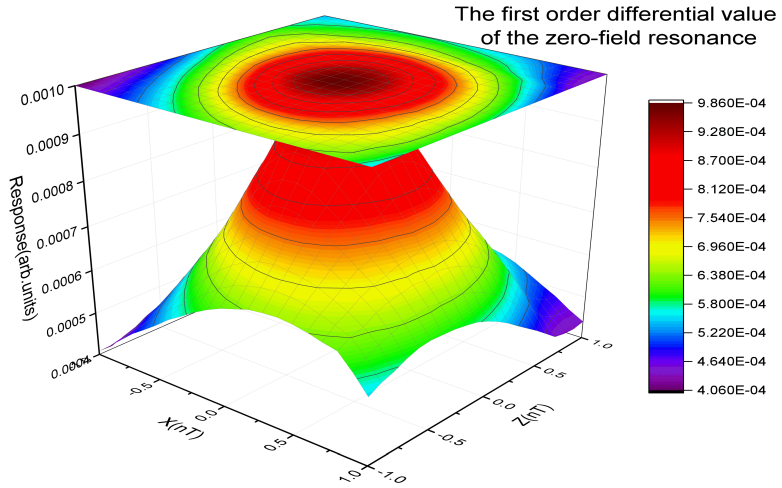

Figure 1. The experimental results of compensating the magnetic fields in the direction of x- and z-axis. The maximum is 9.86E-4 when the magnetic field along the x- and z-axis reach to zero simultaneously. The compensation precisions are 9 pT and 7 pT for x- and z-axis respectively.

[1] Ledbetter M P, Savukov I M, Acosta V M, et al. Spin-exchange-relaxation-free magnetometry with Cs vapor, Physical Review A, **77(3): 033408**, (2008).