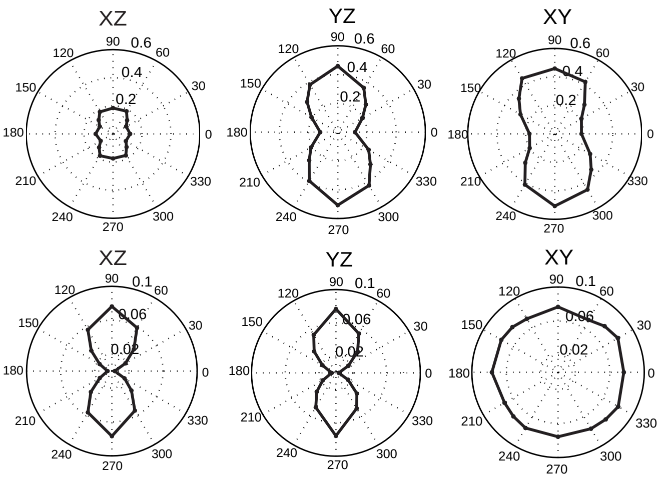

FIG. 3: Contrast measurements along the three major planes. Upper set corresponds to the new magnetometer. The lower set corresponds to a specific laser light detuning (see text) in which the CPT contribution to the signal is canceled and only "regular" Bell-Bloom contribution appears with a clear Dead Zone along the $\hat{z}$ axis. Note the factor of 6 difference in scales between the two sets and that the chosen laser detuning for canceling the CPT signal is not necessarily an optimized case for the BB contrast.

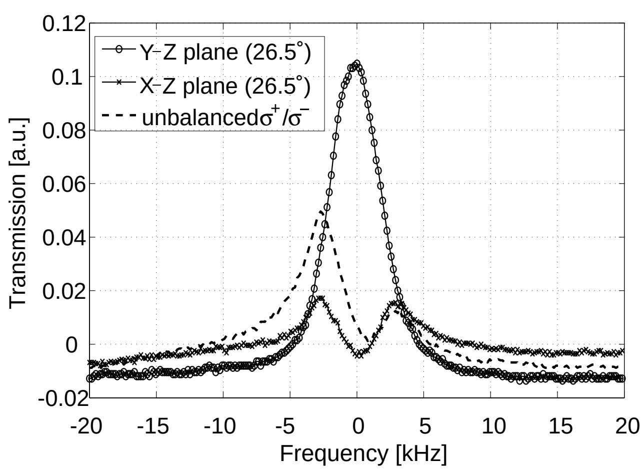

FIG. 4: The magnetometer's response at 2.85 Gauss (2 MHz). The two symmetric traces correspond to a magnetic field tilted toward the $\hat{z}$ axis by 26.5° from the $\hat{x}$ or the $\hat{y}$ axis. The asymmetric signal (in the X-Z plane) corresponds to an unbalanced σ^+/σ^- contribution, obtained by inducing an additional bias to the EOM's driving voltage.

simple polarization modulation scheme. Such technique can be applied to both alkali-metal and metastable ^{4}He magnetometers. We expect that the sensitivity of such magnetometer can reach picotesla level since measured CPT contrast ratio and linewidth are similar or better than in previous CPT magnetometers [18, 19]. In the simplest implementation of the magnetometer, frequency modulation at a few hundred hertz of the voltage applied to the EOM can be used to lock to the maximum of the average transmission through the cell. It is also possible to further improve the performance of the magnetometer by measuring the phase of the second and fourth harmonics of the Larmor frequency in the transmission signal, analyzing the polarization of the transmitted light or using a separate probe laser. The amplitude of the EOM excitation can also be continuously adjusted to maximize the signal for any given orientation of the magnetic field.

The heading errors specific to alkali-metal magnetometers in geomagnetic field are also largely eliminated due to symmetric optical pumping. Thus we expect that this technique will enable high precision isotropic magnetometry in many Earth-bound and space applications. Moreover, controlled excitation of orientation and alignment by polarization modulation of light can be used for better control of the atomic density matrix in various atomic physics experiments.

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