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IT20 Signal reversing cavity-based polarimetry: Evanescent-wave and ambient chiral sensing

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Chirality is a fundamental property of life, and sensing and analysis is very important in various scientific fields such as biology, chemistry, and medicine, as well as in the pharmaceutical, chemical, cosmetic, and food industries. The most widely used chiral sensing techniques are optical rotary dispersion (ORD) and circular dichroism (CD). However, ORD and CD signals are typically very small and are limited by spurious birefringence and poor background subtraction procedures, which place severe constraints on detection sensitivity and time resolution.
Recently, our group has introduced a new cavity-based,[1,2] which overcomes all these problems. The OR signals are enhanced by a factor on the order of the number of cavity passes. The signal reversals incorporated in this method allow chiral measurements without the need for background subtraction. Additionally, the noise suppression resulting from these reversals allows the measurement of relatively small OR in the presence of large birefringence.
The experimental set-up is shown in Figure 1a. The bowtie-configuration optical cavity which supports two distinct, counter-propagating modes. The different symmetry of the polarization rotation caused by either the

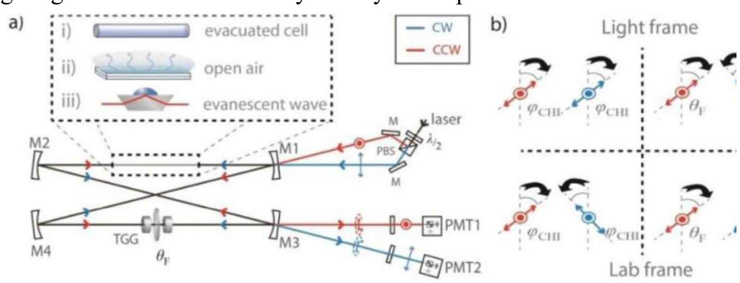

Fig. 1 a) Experimental set-up, showing the optical cavity, magneto-optic element (TGG) and the two counter-propagating modes b) Chiral and Faraday rotation in the light frame (up) and in the light frame (down).

chiral sample or the magneto-optic element is shown in Figure 1b. Subtracting those angles for the two counter-propagating modes and reversing the direction of the magnetic field provides the signal reversals.
This cavity-based technique improves chiral sensitivity limits while opening the way for new applications, which include measurements of human body fluids, studies of surface chirality and biomolecule interfacial processes, studies of vibrational circular dichroism (VCD) of biomolecules and more. Additionally, the ability to perform chiral detection without the need for background subtraction allows the *in situ* chiral measurements, such as chiral forest emissions. Finally, further improvement of the sensitivity of the technique might allow studies of parity violation of the weak force.[3]

References

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