Contribution ID: **64** Type: **Oral presentation**

Long term stability of an EIT based magnetometer.

Thursday 7 August 2025 09:10 (20 minutes)

Magnetometers based on Electromagnetically Induced Transparency (EIT) have shown the capability of vector and scalar measurements of magnetic fields in an all-optical interrogation scheme [1, 2]. The magnetic field strength is derived from a relative frequency shift of the atomic resonances proportional to its magnitude, with a scaling factor that depends only on fundamental constants of nature. The orientation of the field can be determined with respect to a fundamentally orthogonal reference frame defined by the wave vector and polarization of the optical field. This intrinsically accurate and stable magnetometer has recently gain attention due to its adaptability to compact systems based on microfabricated atomic cells [3], making it of particular interest in applications where long term and autonomous measurements are required as it eliminates the need of external calibrations. However, the optical detection can degrade the fundamental magnetometer's performance over long integration times due to the effect of the light shift. In this talk we will explain the basic operational principle of the vector CPT magnetometer and present a novel technique that addresses the light shift problem by using linearly polarized light. Among the scalar, vector and tensor components of the light shift, the vector part has a direct impact on the magnetometer performance as it effectively behaves as an additional magnetic field [4]. The linear polarization suppresses this component, so that just the scalar and tensor parts are present [5]. A further cancellation of the remaining drift is obtained using a multi-frequency interrogation technique, called frequency hopping. The reported results provide a promising path toward a highly stable chip-scale vector magnetometer.

*The work was done in collaboration with The College of William & Mary and JPL, and the authors would like to acknowledge the useful inputs from Irina Novikova, Eugeniy E. Mikhailov, James A. McKelvy and Andrey Matsko.

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Session Classification: OPM Development I