Towards a Mobile, and Magnetically Quiet Optically Pumped Magnetometer

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When shielding properties like field homogeneity and residual field stability inside magnetically shielded rooms to be measured, an absolute and though stable and reproducible sensor is desired. But also for other experiments as e.g. for the investigation of the basics of physics [1] absolute accuracy and, if possible, no field interference from the sensor itself are required. Optically pumped magnetometers (OPM) enable the measurement of the absolute magnetic field with potentially high accuracy. In this context, we have built a laboratory prototype of a magnetically quiet optical pumped magnetometer on an optical table. The setup consists of a stabilized laser diode, an electrooptical modulator, a cesium-vapor cell, and a photo diode for the readout of the laser light. The OPM operates in free spin precession mode to measure the absolute magnetic field by evaluation of the spin ensemble frequency after pumping by applying alternating laser power [2]. We present measurements of the laser frequency-, and power-stability, as well as the magnetic field inside a TwinLeaf MS-2 shield in the laboratory environment. To further improve stability and thus also as a prerequisite for higher accuracy, the laser is placed on an air-damped small optical table inside a thermo-acoustically decoupled aluminum box. Additionally, this setup offers a mobile system to be used independent from laboratory environment.

References

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