An universal optically pumped multi-beam magnetometer for zero- and finite-field conditions.

Georg Bison[1]

[1] Paul Scherrer Institut, Switzerland

Optically pumped magnetometers (OPM) that operate in zero field are based on the ground state Hanle effect. OPM that operate in finite fields use either free or driven spin precession which differs conceptually from the zero-field case. Most OPM are optimized for one of the two field regimes and cannot operate in the other. This presentation will give details about a OPM variant that can operate in both regimes [1]. It uses four laser beams which all contribute equally to optical pumping of Cs atoms contained in a paraffin coated cell [2]. All four beams are also used for probing which results in four input signals that can be use to estimate the magnetic field modulus [3] and/or vector components [1,3]. The algorithms used to process the data will be discussed in detail and performance obtained in measurements will be compared to theoretical expectations.

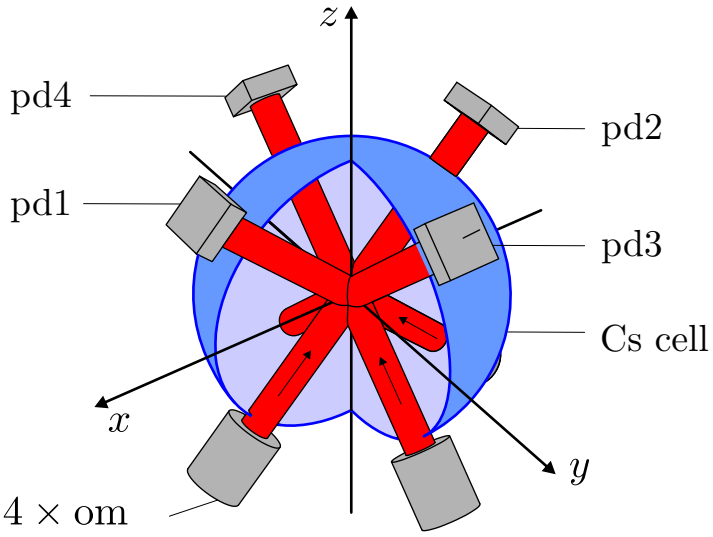

Figure 1. Schematic depiction of the cell containing the Cs atoms, the four laser beams formed by optical modules (om) and the photo diodes (pd).

[1] G. Bison, V. Bondar, P. Schmidt-Wellenburg, A. Schnabel, and J. Voigt, Sensitive and stable vector magnetometer for operation in zero and finite fields, Opt. Exp. **26**, 17350-59 (2018).
[2] N. Castagna, G. Bison, G. di Domenico, A. Hofer, P. Knowles, C. Macchione, H. Saudan, and A. Weis, A large sample study of spin relaxation and magnetometric sensitivity of paraffin-coated Cs vapor cells, Appl. Phys. **B 96**, 763–772 (2009).
[3] S. Afach, G. Ban, G. Bison, et al., A highly stable atomic vector magnetometer based on free spin precession, Opt. Exp. **23**(17), 22108–15 (2015).