Sub-pT optical magnetometry with squeezed light

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Optical and atomic quantum noise in magnetometry can be reduced by optical squeezing and spin squeezing, respectively. Dispersive readout, e.g. by Faraday rotation, can moreover produce spin squeezing, an effect that is expected to improve when squeezed light is used. **We report quantum enhancement of a high density Bell Bloom optical magnetometer with ~100 fT/$\sqrt{}$(Hz) sensitivity, simultaneously limited by optical and atomic quantum noise**. **Using off-resonant polarization squeezed light generated in a subthreshold optical parametric oscillator we probe a polarized ensemble of 10^{13} atoms/cm^3 and achieve an increase of the signal to noise ratio. This improves the magnetometer's bandwidth and sensitivity beyond the prior squeezed light enhanced magnetometry records of** nT/$\sqrt{}$(Hz) in 2010 [2] and 2 pT/$\sqrt{}$(Hz) in 2012 [3]. The instrument can be a testbed for the study of optical and atomic quantum noise and their interaction in magnetometry.

References

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