Noise suppression techniques in atomic magnetometry for portable sensors

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Unshielded atomic magnetometry is well suited for portable, compact sensors. Operating in an unshielded environment brings specific challenges - periodic magnetic noise in particular can limit sensitivity. A variety of noise suppression and compensation techniques have been demonstrated [1,2]. We are developing techniques for noise suppression for use in small sensors with simple geometry and micro-fabricated components. The dominant magnetic noise source in many unshielded environments is the 50 Hz mains current. In our double-resonance magnetometers, this large amplitude periodic noise slews the Larmor frequency outside the linear regime of the resonant response to the RF field. We have developed a measurement scheme which dynamically follows the ambient noise using a feed-forward technique, achieving 50 Hz noise suppression of 20 dB and a reduced total white noise floor. Our efforts to produce unshielded devices insensitive to periodic noise will be discussed here, including feed-forward and gradiometric schemes.

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