

Performance of a radio-frequency two-photon atomic magnetometer for different magnetic induction measurement geometries

L. M. Rushton, L. M. Ellis, J. D. Zipfel, P. Bevington, W. Chalupczak

National Physical Laboratory, Hampton Road, Teddington, TW11 0LW, United Kingdom

Measurements monitoring the inductive coupling between oscillating radio-frequency fields and objects of interest create versatile platforms for non-destructive testing. Obvious benefits of the measurements at low frequencies, i.e. below 1~kHz, are sometimes outweighed by the fundamental and technical difficulties related to operating pick-up coils or other field sensors in this frequency range. Inductive measurements with the detection based on a two-photon interaction in radio-frequency magnetometers addresses some of these issues, through a combination of the sensor having frequency-independent sensitivity and an uplift in its operational frequency. In this paper, systematic studies of the technique are presented that integrate fundamental and applied aspects of the process.