Post deadline abstracts

Poster session - Tuesday

Imperfect cloaking devices based on metamaterials

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Cloaking devices designed using the coordinate transform approach have been shown to be realizable, at least in principle, within the realm of electromagnetic metamaterials. In this paper we investigate the strictness of conditions imposed on the parameters of metamaterial cloaks by calculating the degree of wave scattering when those parameters deviate from the ideal values. A simple idea is used to obtain analytic results for the case of the nonideal two-dimensional cloaking cylinder. Also, results of finite element simulations of the Helmholtz equation are presented and it is found that they are in excellent agreement with the analytic results.

All-optical magnetometer based on Rb atoms irradiation by frequency modulated diode laser light r

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For many applications, precise and sensitive magnetic field (MF) measurement is needed. Recently, the effect of Coherent Population Trapping (CPT) has been investigated developing all-optical sensor with the aim of application for MF measurement with good absolute accuracy, high spatial resolution and wide diapason of performance.

In this communication we present our results of MF measurement based on CPT resonances at the D_1 line of ^{87}Rb observed in the fluorescence of Rb atoms by means of coupling of two ground-state Zeeman sublevels belonging to different hyperfine levels to a common excited-state one. For this, two coherent laser fields with frequency difference of about 3.4 GHz are used. They are produced by direct current modulation of a diode laser. The CPT signal is registered in a first derivative applying an additional laser frequency modulation at 0.8kHz. The CPT resonance is split by the measured MF and the difference between laser modulation frequencies at the centres of different components is a measure of the magnetic field. The resonance splitting dependence on light polarization and orientation of the measured MF will be discussed. The CPT resonance spectra in laboratory MF will be presented. The CPT spectrum components dependence on laser modulation, light intensity and magnetic field gradients is systematically examined in order to optimize the sensitivity and accuracy of magnetic field measurement. The laser frequency modulation index is chosen in a way to avoid significant broadening of the CPT spectrum components. The radiation broadening of the components is also minimized. MF gradients and 50Hz alternating MF result in different influence on the profiles of the CPT spectrum components. A methodology for magnetic gradient measurement is proposed based on the shape of the CPT spectrum components.

The developed methodology can be used for magnetic field measurement in many fields including magnetic field mapping of plasma objects with high accuracy and spatial resolution.

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A magic wavelength dipole trap for single atoms

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We present an experiment in which a dipole trap operating at the magic wavelength of caesium [1] creates a state-insensitive trapping environment. This enables trapped atoms to be continuously monitored and probed whilst confined within the dipole potential.

The specific properties of this trap also present the opportunity to produce a deterministic source of laser cooled single atoms via a mechanism of 'collisional blockade' [2, 3, 4], and we describe possible experiments to be carried out using this setup on the observation of coherent population trapping [5, 6], in single atoms.

References

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