Experimental realization of coherent dark-state magnetometers

A. Nagel, L. Graf, A. Naumov(*), E. Mariotti(**), V. Biancalana(**)
D. Meschede and R. Wynands

Institut für Angewandte Physik, Universität Bonn
Wegelerstraße 8, 53115 Bonn, Germany

(received 3 April 1998; accepted in final form 28 July 1998)

PACS. 42.50Gy – Effects of atomic coherence on propagation, absorption, and amplification of light.
PACS. 32.70Jz – Line shapes, widths, and shifts.
PACS. 07.55Ge – Magnetometers for magnetic field measurements.

Abstract. — Coherent population trapping resonances in cesium vapor can be used to determine DC flux densities in the range from 1 μT to 1 mT with typically 3·10^{-5} relative uncertainty. For fields modulated at a few kHz, we find sensitivities of below 10 pT within 0.5 s integration time. From the signal-to-noise ratio the sensitivity can be extrapolated to 500 fT/√Hz. A quantitative understanding of the lineshape allows to detect DC fields of several nT even when the Zeeman components of the resonance are not resolved.