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Heterodyne-based optical probe with sub-kHz resolution for coherent atomic media RUSSELL MCLEAN, ALEXANDER AKULSHIN, Centre for Atom Optics and Ultrafast Spectroscopy, Swinburne University of Tecnology, Melbourne, Australia — We have demonstrated a coherent heterodyne technique for probing atomic media containing laser-induced coherence. Optical heterodyning with mutually coherent laser fields allows the detection of new spectral components generated by phase modulation and four wave mixing. The technique has sub-kHz resolution, well below the laser linewidth limit. We use two applied radiation fields tuned to particular transitions within the Rb D lines and separated by a small frequency offset, typically 100 kHz or less, to generate an enhanced atomic Kerr nonlinearity in a Rb vapour through the processes of coherent population trapping and coherent population oscillations. In the heterodyne technique the transmitted fields, including the new fields resulting from these processes, are mixed with a reference field tuned beyond the region of enhanced nonlinear susceptibility, to generate beat signals observable on an RF spectrum analyzer. With a suitable choice of polarizations for the two applied fields the technique has allowed us to distinguish the processes responsible for generating the enhanced nonlinearity, and represents a novel method of probing coherent atomic media that is complementary to the more commonly used drive-probe and Hanle-type methods.

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