Twin beams relative intensity squeezing by Four Wave Mixing in potassium vapor

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We report detailed study of intensity difference squeezing generated by Four-Wave-Mixing (FWM) in hot potassium vapor. Previous studies of the squeezing in alkalis were done mainly for Rb and Cs [1, 2], with a squeezing of -8.8 dB and -6.5 dB, respectively. Only a few works exist on squeezing by FWM in Potassium [3].

For the FWM process we used non-degenerate double Λ scheme, with pump (one-photon detuning, OPD) and two photon pump-probe detuning (TPD) as parameters. The source for the pump and probe beams was the high power MBR (Coherent) laser. The beams enter 2.5 cm long K cell at the 4.5 mrad mutual angle. The K cell windows are AR coated both outside and inside. For measuring the intensity difference of the probe and conjugate after the cell we used balanced detectors with detection efficiency of 0.82 and a gain of 10^5 V/A. The signal difference was analysed using the spectrum analyzer.

We have varied number of parameters, and have found the best squeezing of about –7 dBm, before the correction for losses on the cell windows and optics used behind the cell. This level of squeezing was obtained at pump and probe powers of 850 mW and 5 μW, OPD and TPD of 1.1 GHz and 8 MHz, respectively, and the cell temperature of 121^oC. Our result is a strong improvement of previously published values for intensity squeezing in K [3]. We analysed effects of OPD and of TPD on the relative intensity squeezing and on gains of the twin beams for several cell temperatures, and compare them with behavior of squeezing and gains found in Rb and Cs [1,2].

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