Quantum Noise in EIT-based Quantum Memory in the Presence of Four-Wave Mixing

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Abstract

We study the coherent properties of amplified slow and stored light pulses by four-wave mixing (FWM) in a double-Λ system using the beatnote interferometer. An energy gain of 17 with a pump laser intensity as low as 1 mW/cm^2 is obtained with optically dense, cold atomic samples. The effect of quantum noise in the amplified light due to the finite excited state population is observed. Its dependence on the pump laser intensity, detuning and the optical depth is systematically studied. Our work show that the incoherent component in the amplified light by four-wave mixing needed to be considered at large FWM coupling strengths. We also compare our results with a recent theoretical paper [Phys. Rev. A 88, 013823(2013)] on this topic.