

## Large Enhancement of Probe Amplification with Population Inversion in a Four-Level Atomic System with Vacuum-Induced Coherence

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**Abstract:** In this paper, we discuss and analyze theoretically probe absorption-amplification response in a four-level coherent atomic system with vacuum-induced coherence via changing the sign of the parameter  $f$ , with  $f$  denoting the ratio of a pair of dipole moments associated with a doublet of closely upper hyperfine sublevels. We find that the amplitude of the probe amplification for the case  $f=-1$  can be about one order of magnitude larger than that achievable for the case  $f=1$ . In addition, with respect to the case  $f=-1$  the probe amplification can be maintained all the time with weak incoherent pumping for a wide range of the probe detuning.

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Key words: probe absorption-amplification, population inversion, vacuum-induced coherence

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