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Giant Kerr nonlinearity in an n-doped semiconductor quantum well

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Abstract A scheme for enhancement of Kerr nonlinearity with vanishing linear and nonlinear absorption in a three-level ladder-configuration n-doped semiconductor quantum well is proposed. It is shown that the Kerr nonlinearity can be controlled and even enhance by the intensity of coupling fields. Also, phase control of Kerr nonlinearity is then discussed.

Keywords Kerr nonlinearity · Electromagnetically induced transparency · Linear and nonlinear absorption

1 Introduction

Optical properties of an atomic medium can substantially be modified by application the external fields. Quantum coherence and quantum interference are the basic mechanisms for modifying the response of the atomic medium to the applied fields. There are several interesting phenomena in quantum optics that induced by quantum coherence and interference, such as lasing without inversion (LWI) (Mompart and Corbalan 2000; Li et al. 2005; Allahverdyan et al. 2005; Fan et al. 2006), cancellation of spontaneous emission (Xia et al. 1996), subluminal and superluminal light (Keitel 1998; Wang et al. 2000; Hau et al. 1999; Kash et al. 1999), the electromagnetically induced transparency (EIT) (Harris 1997; Scully and Zubairry 1997; Litvak and Tokman 2002; Wu and Yang 2005), and optical bistability (Sahrai et al. 2011a,b). In the EIT medium, the strong coherent laser field provides the atomic phase coherence that is responsible for the transparency of the medium. In fact, EIT has opened up a new rote for controlling the absorption and the dispersion properties of an atomic medium (Kocharovskaya and Khanin 1998; Harris 1999; Litvak and Tokman 2002; Wu and Yang 2005). In an EIT medium the weak probe field will not be absorbed when strong coupling field incident upon

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