

Nonlinear Absorption and Dispersion Response in Optically Dense Media Driven by a Single-Mode Laser

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Abstract: Taking the density-dependent near dipole-dipole (NDD) interaction into consideration, we theoretically investigate the response of nonlinear absorption and dispersion in optically dense media of three-level atoms driven by a single-mode probe laser. The influence of the NDD effects on the absorption and dispersion spectra of the probe field is predicted via numerical calculations. It is shown that the NDD effects reduce gradually to transient absorption and amplification with the increase of the strengths of the NDD interaction, but do not change the steady-state behavior. Due to the presence of the NDD effects, steady-state absorption spectra exhibit asymmetric double-peak structure and overall shifts when a continuous-wave (cw) probe field is applied. However, frequency dispersion spectra are insensitive to them near the zero detuning.

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Key words: absorption spectra, dispersion spectra, near dipole-dipole interactions

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