

Electromagnetically Induced Transparency in a Four-Level Atomic System

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Abstract: In this paper, we analyze and discuss the absorption properties of the probe beam in a four-level atomic system with a nearly hyper-fine doublet structure of two higher-lying excited levels based on electromagnetically induced transparency (EIT) for the two cases of transient process and steady-state process. The main gain of this work is to investigate theoretically the influence of the nearly hyper-fine levels on the probe absorption. For the transient process, using the numerical calculations by a simple Mathematica code we find that the magnitude of the probe absorption at the line center is small compared to the typical three-level atomic system in the context of electromagnetically induced transparency. For the case of the steady state, our results show that the probe absorption can be completely eliminated at the line center of the probe transition just as the usual three-level EIT scheme.

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Key words: transient absorption, steady state, electromagnetically induced transparency

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