

Transient Dynamics of Light Propagation in Λ -Atom EIT Medium

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Abstract: We investigate the transient phenomenon or property of the propagation of an optical probe field in a medium consisting of many Λ -type three-level atoms coupled to this probe field and a classical driven field. We observe a hidden symmetry and obtain an exact solution for this light propagation problem by means of the spectral generating method. This solution enlightens us to propose a practical protocol implementing the quantum memory robust for quantum decoherence in a crystal. As a transient dynamic process this solution also manifests an exotic result that a wave-packet of light will split into three packets propagating at different group velocities. It is argued that "super-luminal group velocity" and "sub-luminal group velocity" can be observed simultaneously in the same system. This interesting phenomenon is expected to be demonstrated experimentally.

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