

Slow γ photon with a doublet structure: Time delay via a transition from destructive to constructive interference of collectively scattered radiation with the incoming photon

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Abstract

Single γ photon propagation in a dense absorptive medium with two widely spaced resonances is experimentally studied. After an initial fast decay, a revival of the photon amplitude in the form of a bump, exceeding the probability amplitude of the incident photon, is observed. The irradiation time of this bump delays approximately by the lifetime of the excited nuclei in the absorber. This effect is explained by the interference of the incoming radiation with the collectively scattered radiation, the phase of which is modulated with the frequency of the doublet splitting. Initially, the destructive interference changes to a constructive one, distinguishing the storage and retrieval stages of the photon propagation in a dense medium, i.e., the collective absorption and collective re-emission processes. © 2009 The American Physical Society.

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