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All-optical quantum storage based on spatial chirp of the control field

Zhang X., Kalachev A., Kocharovskaya O.

Kazan Federal University, 420008, Kremlevskaya 18, Kazan, Russia

Abstract

© 2014 American Physical Society. We suggest an all-optical quantum memory scheme which is based on the off-resonant Raman interaction of a signal quantum field and a strong control field in a three-level atomic medium in the case where the control field has a spatially varying frequency across the beam, called a spatial chirp. We show that the effect of such a spatial chirp is analogous to the effect of a controllable reversible inhomogeneous broadening of the atomic transition used in the gradient echo memory scheme. The proposed scheme does not require temporal modulation of the control field or the atomic levels and can be realized without additional electric or magnetic fields. This means that materials demonstrating neither linear Stark nor Zeeman effects can be used and/or materials which are placed in specific external fields remain undisturbed.

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