

Laser Physics Letters 2006 vol.3 N9, pages 423-426

Low magnetic fields behavior of photon echo in LuLiF₄:Er³⁺

Lisin V., Samartsev V., Shegeda A., Zuikov V., Korableva S.
Kazan Federal University, 420008, Kremlevskaya 18, Kazan, Russia

Abstract

It is reported about the first observation and studying of the photon echo in LuLiF₄:Er³⁺. The energy transition is $4I_{15/2} \rightarrow 4F_{9/2}$ ($\lambda = 6536 \text{ \AA}$). The density of ErF₃ is 0.025 wt%. The operation temperature is 1.9 K. Measurements were spent at low (up to 1200 Oe) and even zero external magnetic fields. It was studied a behavior of the photon echo intensity versus the magnetic field magnitude and direction about the crystal axis C and versus the laser pulse separation t_{12} . It was observed an exponential growth and then, after some plateau, an exponential decreasing of the photon echo intensity as a function of magnetic field with increasing of the magnetic field from zero value. The parameters describing the exponential growth and decreasing are not depended on direction of magnetic field. Value of a magnetic field at which the echo intensity accepts the maximum, and quantity of this maximum decrease with increased the pulse separation t_{12} and the angle θ between the magnetic field and crystals axis. The echo intensity exponentially decreases with increased θ . The parameter describing the exponential decreasing is not depended on the magnitude of the field. The echo intensity as a function of pulse separation shows exponential decay. The phase relaxation time is depended on the magnitude and direction of the magnetic field. T_2 is equal to 202 ± 16 ns at zero magnetic field. Phenomenological formula is suggested, which qualitatively presents the mentioned dependencies. Polarization properties of the backward photon echo in this crystal are studied also. A graph is presented. Echo size versus magnetic field directed as along optic axis as at an angle of $\theta = 5^\circ$ of different values of t_{12} . The color symbols show experimental points. The solid curves were calculated using expression (1). The Y-scale is logarithmic. © 2006 by Astro Ltd. Published exclusively by Wiley-VCH Verlag GmbH & Co. KGaA.

<http://dx.doi.org/10.1002/lapl.200610025>

Keywords

Backward echo, Erbium ion, Low magnetic field, LuLiF₄-crystal, Phase relaxation, Photon echo