

Photon echo of an ultranarrow optical transition of $^{167}\text{Er}^{3+}$ in $^7\text{LiYF}_4$ crystals

Minnegaliev M., Baibekov E., Gerasimov K., Moiseev S., Smirnov M., Urmancheev R.
Kazan Federal University, 420008, Kremlevskaya 18, Kazan, Russia

Abstract

© 2017 Kvantovaya Elektronika and Turpion Ltd. The longitudinal and transverse relaxation times for a transition between hyperfine sublevels of the lower electronic states of the $4\text{I } 15/2$ and $4\text{I } 9/2$ multiplets of $^{167}\text{Er}^{3+}$ ions in $^7\text{LiYF}_4$ crystals have been determined for the first time using two-pulse and stimulated photon echo measurements in zero magnetic field at a temperature of 4 K. The decay of the photon echo signal has been shown to be modulated, which is tentatively attributed to the superhyperfine interaction of the $^{167}\text{Er}^{3+}$ ions with their 19 F- nearest neighbours. The contributions of various types of interaction to the ultranarrow linewidth (~ 24 MHz) of the transition in question are discussed. Our results demonstrate that this optical transition of the $^{167}\text{Er}^{3+}$ ion in $^7\text{LiYF}_4$ crystals is potentially attractive for use in Raman quantum memory schemes.

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Keywords

Er, LiYF_4 , Optical spectroscopy, Photon echo, Raman quantum memory, Rare-earth ions, Ultranarrow optical absorption lines

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