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High-resolution magneto-optical spectroscopy of LiYF₄: Er³⁺ 167, Er³⁺ 166 and analysis of hyperfine structure of ultranarrow optical transitions

Gerasimov K., Minnegaliev M., Malkin B., Baibekov E., Moiseev S.
Kazan Federal University, 420008, Kremlevskaya 18, Kazan, Russia

Abstract

© 2016 American Physical Society. We performed high-resolution magneto-optical spectroscopy of the hyperfine transitions from I_{15/24} to the I_{13/24} and I_{9/24} multiplets of Er³⁺167 and Er³⁺166 in an isotopically purified LiYF₄ crystal in various external magnetic fields up to 0.7 T. The obtained experimental results are interpreted in the framework of the generalized theoretical approach. The derived model successfully explains all the experimentally observed optical hyperfine transitions by using a single set of basic parameters found for the crystal-field interaction, magnetic dipole and electric quadrupole hyperfine interactions, together with Zeeman interactions at different orientations of the external magnetic field. A number of the studied quantum transitions appears to be promising for use in Raman quantum storage at optical telecommunication wavelengths.

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