

Breaking of the selection rules for optical transitions in the dielectric $\text{PrFe}_3(\text{BO}_3)_4$ crystal by a praseodymium-iron exchange interaction

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Abstract

We report on the emergence of new lines in the optical spectrum of the $\text{PrFe}_3(\text{BO}_3)_4$ single crystal at the magnetic ordering temperature. The transitions between singlet crystal-field sublevels of Pr^{3+} ion with the same transformational properties, strictly forbidden for the trigonal D_3 point symmetry of this ion in $\text{PrFe}_3(\text{BO}_3)_4$, appear below the Néel temperature and grow in intensity as a square of the order parameter. We show that the phenomenon originates from the mixing of wave functions of different Pr^{3+} sublevels by the Pr-Fe exchange interaction.
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