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Experimental Investigation on the Low-Temperature Anomalies in Dysprosium Iron Garnet (DyIG)

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Abstract

The anomalous physical properties of dysprosium iron garnet $Dy_3Fe_5O_{12}$ or DyIG single crystals have been revisited at low temperatures. This paper presents results of experimental investigation based on specific heat, magnetization, and Faraday rotation measurements. The distinguishing features are the occurrence of two types of anomalies in the temperature dependences of some judicious quantities. The first one coincides with the previous first-order spin reorientation transition at T_{SR} = 15 K where the iron sublattice magnetization vector $\boldsymbol{M}_{\mathbf{Fe}}$ changes from the <111> axis at high temperature toward the low angular <uuw> phases below T_{SR}. The second one takes place around the "low-temperature Belov point" T_B = 42 K, confirming what had already been predicted

previously about the paraprocess effect in this ferrimagnet. The results are compared with previous findings and discussed taking into account the coexistence of some concomitant phenomena such the magnetodielectric and Schottky effects which cause anomalies, respectively near T_{SR} and T_B.

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