

Magnetic ordering in terbium ethyl sulphate

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Abstract

The magnetic properties of terbium ethyl sulphate, a singlet crystal-field ground-state system with predominantly dipolar interactions between the magnetic ions, have been studied theoretically and experimentally at low temperatures. The susceptibilities parallel and perpendicular to the hexagonal *c* axis were measured in the temperature range 0.03-4 K by a superconducting-quantum-interference-device magnetometer in connection with a dilution refrigerator. In addition, the heat capacity of a powdered sample was measured. The results indicate a cooperative transition at 0.24 K. The data give indirect information on the value of the crystal-field splitting, which has not been measured before. The behavior of the longitudinal susceptibility is consistent with a picture of a ferromagnetic transition into long and thin domains along the *c* axis. The much smaller transverse susceptibility shows an unexpected abrupt change at 0.24 K. Theoretical calculations on the magnetic properties are presented. The molecular-field approximation, two- and three-particle "cluster" models and high-temperature expansion are considered in turn. The predictions of the three-particle cluster model are closest to the experimental data. © 1975 The American Physical Society.

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