THE PHASE DIAGRAM OF II-ND TYPE ANTIFERROMAGNET

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We investigate theoretically the second type antiferromagnets with f.c.c. structure and with n.n.n. exchange interactions taken into account. The magnetic structure is that of europium monochalcogenides EuX (X=O,S,Se,Te). The main aim of the paper is to investigate the influence of biquadratic interactions, and the long-range dipolar interactions, on the phase diagrams. For this purpose the molecular field approximation has been adopted. Starting from the Bogolyubov inequality, the Gibbs energy of the antiferromagnet has been obtained. On this basis we are able to derive all thermodynamic properties of the system. In particular, the analytic formula for the Néel and asymptotic Curie temperatures has been derived. The zero-field phase diagrams have been calculated numerically in the range of parameters corresponding to real materials (EuTe). It has been shown that the biquadratic, as well as the long-range dipolar interactions, have a remarkable influence on the phase diagram. This, in turn, results in verification of the n.n. and n.n.n. exchange parameters known from literature. For some specific ratio of these parameters the transition from antiferromagnetic to ferromagnetic phase has been found, which is in accordance with recent experimental data obtained for EuTe in the presence of high pressures. The results are illustrated in the figures and discussed.

9.7 cm

13.4 cm

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