3D ($H-\theta-\varphi$) magnetic phase diagram of ErB_{12} antiferromagnetic metal with dynamic charge stripes

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The presence of several simultaneously active degrees of freedom in strongly correlated electronic systems (SCES) often leads to the formation of complex, multicomponent phase diagrams [1] (see, for example, Mn oxides called manganites and HTSC cuprates). Such solids can be extremely useful in practice, exhibiting a giant response to weak external perturbations, but often have a complex chemical composition and low crystal structure symmetry. It was established recently, that magnetic RB_{12} dodecaborides (R=Ho, Er, Tm) can be treated as model SCES, having electronic phase separation (dynamic charge stripes along the <110> axis) [2,3] with incommensurate antiferromagnetic ground state. Previous studies of HoB_{12} antiferromagnet have shown the presence of the strongest magnetoresistance anisotropy in the form of a Maltese cross with numerous magnetic phases [4].

The aim of this work is to investigate the nature of the charge transport anisotropy and the appearance of a large number of magnetic phases in the highly symmetric ErB_{12} single crystal. Since the orientation of the magnetic moments in ErB_{12} strongly depends on both the magnitude and the direction of the external magnetic field, we measured the magnetization and magnetoresistance in the range of magnetic fields up to 8 T at liquid helium temperatures with the rotation of the sample during the experiment around different principal axes in the crystal.

A detailed study of the location of phase boundaries showed that the main sectors of the phase diagram are formed along directions perpendicular (H || [001]) and parallel (H || [110]) to dynamic charge stripes. From the analysis of the reconstructed 3D magnetic phase diagram, it was concluded that dynamic fluctuations of the electron density (charge stripes) are responsible for the suppression of the indirect Ruderman-Kittel-Kasuya-Yoshida (RKKY) exchange between the neighboring Er^{3+} ions located in the <110> directions.

References:

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