

# 21世紀 COE & 極限量子科学研究センター ジョイントセミナー

## Field-induced magnetic phase transitions in rare-earth - transition-metal compounds

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概要：If sufficiently high magnetic fields are applied, ferrimagnetic rare-earth (R)-transition-metal (T) compounds exhibit magnetic phase transitions which occur as a result of the competition of the various interactions in a material in the presence of the applied field.

Earlier high-field studies on single crystals of  $R_2Fe_{17}$  and  $R_2Fe_{17}$  compounds have shown the occurrence of some transitions but, unfortunately, only in a very limited number of these compounds because, usually, the transitions take place at higher fields than experimentally accessible. Analysis of the available experimental data has led to a, for one decade, satisfactory theoretical description of the phase transitions in these compounds, predicting the critical-field values for all transitions [1]. However, recently, this description has been disputed and it has been argued that depending on the relative strengths of the R- and T-anisotropies phase transitions may vanish [2]. This has triggered us to start additional high-field measurements on a number of  $R_2Fe_{17}$ -based compounds of which results will be presented and discussed.

In recent years,  $RMn_6Sn_6$  and  $RMn_6Ge_6$  compounds have attracted considerable attention. The magnetic structures of these compounds, as determined by neutron diffraction, are quite complicated and a general description of the high-field magnetization measured on single crystals cannot yet be given. It will be argued that a large and strongly variable Mn-anisotropy is likely responsible for this.

At last, it will be shown that, if single crystals are not available, also very informative results may be obtained on samples that consist of powder particles that have been magnetically aligned. Analysis of the high-field magnetization of  $Er_2Co_{17}$  provides all relevant information on the interactions in this compound [3].

- [1] "High-field magnetization of  $R_2T_{17}$  compounds" by J.J.M. Franse, F.E. Kayzel, C. Marquina, R.J. Radwanski and R. Verhoef, *J. Alloys Comp.* 181 (1992) 95.
- [2] "High-field magnetization measurements on  $Er_2Fe_{17}$  single crystals: a new way of determining the inter-sublattice molecular field" by M.D. Kuz'min, Y. Skourski, K.P. Skokov and K.-H. Müller, submitted to *Physical Review B*.
- [3] "High-field moment reorientation in  $Er_2Co_{17}$ " by S. Yoshii, M. Hagiwara, F.R. de Boer, H.Z. Luo, G.H. Wu, F.M. Yang and K. Kindo, submitted to *Physical Review B*.