Max-Planck-Institut für Struktur und Dynamik der Materie

Max Planck Institute for the Structure and Dynamics of Matter

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CFEL Seminar room IV, 01.111 (Bldg. 99)

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Magnetooptical time-resolved study of Eu^{2+} spin dynamics in Eu-122 pnictide superconductors

Recently discovered iron based compounds exhibit superconducting (SC) order next to the magnetically ordered phase. Among various parent compounds of iron pnictide superconductors Eu based stand out due to presence of both, the spin density wave (SDW) ordering of the itinerant carriers in the Fe-d derived bands and the antiferromagnetic (AFM) ordering of the localized Eu^{2+}-*f* spins.

There are contradicting reports on the strength of coupling between the itinerant Fe-*d* carriers and Eu^{2+}-*f* spins. Employing temperature dependent time-resolved optical femtosecond spectroscopy we investigated the quasiparticle relaxation dynamics in $Eu(Fe_{1-x}Co_x)_2As_2$. As previously reported in other iron-based pnictides we observe the relaxation bottleneck due to the charge gap opening in the SDW state below T_{SDW}.

Below the Eu^{2+} AFM spin ordering temperature we observe another slower relaxation component, which we attribute to the Eu^{2+} AFM order relaxation. Slow dynamics of this component suggests a weak coupling between the Eu^{2+} spins and the carriers in the Fe-*d* derived bands.

Employing optical pump-probe femtosecond spectroscopy we investigate the Eu^{2+} dynamics in $EuFe_2(As_{0.7}P_{0.3})_2$ (EFAP) pnictide superconductor and parent nonsuperconducting $EuFe_2As_2$ (EFA) in magnetic field. In both cases we observe an emergence of a slow anisotropic photoinduced relaxation component concurrent with Eu spin ordering. The evolution of the photoinduced reflectivity transients with magnetic field in the superconducting EFAP is different than in the nonsuperconducting EFA. In EFA we observe switching of the optical-transients anisotropy with increasing magnetic field attributed to a field-induced antiferromagnetic (AFM) to ferromagnetic (FM) phase transition. In the superconducting EFAP a large coherent magnon oscillation is observed at a similar metamagnetic transition. The coexistence of SC and FM is also going to be discussed.

Host: Andrea Cavalleri

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