PHYSIK

Physikalisches Kolloquium

Femtosecond Charge and Spin Dynamics in Molecular Magnets

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Despite the rapid expansion of femtomagnetism, molecular magnets have so far been under-explored using ultrafast techniques. These materials offer interesting possibilities because it is possible to systematically tune the nature of the magnetic interactions due to the vast library of structures available with synthetic chemistry, which is not as trivial in conventional magnets. We report the first ultrafast magneto-optical (MO) study of a molecule-based magnet [1]. We found a fast magnetic response on a femtosecond timescale, which was attributed to the super-exchange interaction between the metal ions.

Femtosecond pump-probe spectroscopy was used to measure the MO dynamics of thin films of the V-Cr Prussian blue analogue (PBA), which is a room-temperature molecule-based magnet. The MO measurements could detect a change in the super-exchange interaction taking place as a result of a spin flip occurring in less than 250 fs after the absorption of a pump photon. We have more recently explored the initially excited state by comparing femtosecond transient absorption spectroscopy with spectroelectrochemistry [2] and also developed coloured magnetic heterostructures [3]. These results demonstrate the powerful combination of transient absorption spectroscopy, magneto-optics, and spectroelectrochemistry in understanding photoinduced magnetisation dynamics in magnetic functional materials.

We will also present recent results on femtosecond vibrational coherences in a single-molecule magnet, enabling the possibility to optically modulate the magnetic anisotropy in these interesting molecular systems.

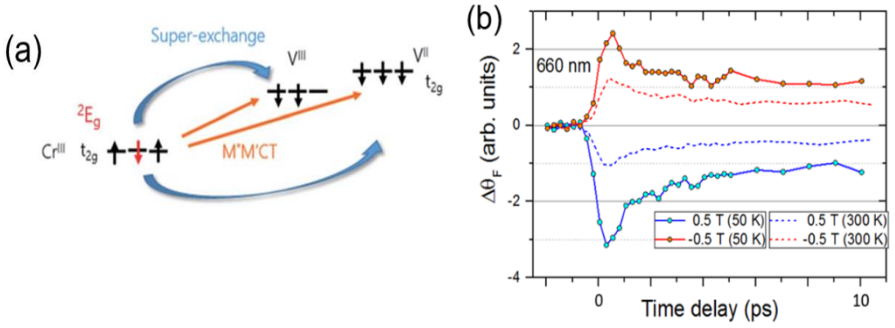

Figure 1: (a) The probe pulse is sensitive to the metal-to-metal charge transfer (MM'CT) transition, which is affected by the change in spin-configuration on the Cr ion after pumping at the ligand-to-metal charge-transfer transition. (b) Change in Faraday rotation ΔθF at 660 nm as a function of pump-probe

[1] J. O. Johansson, J.-W. Kim, E. Allwright, D. M. Rogers, N. Robertson, and J.-Y. Bigot, Chem. Sci. 7, 7061 (2016).
[2] L. Hedley, M. D. Horbury, F. Liedy, and J. O. Johansson, Chem. Phys. Lett. 687, 125 (2017).
[3] L. Hedley, L. Porteous, D. Hutson, N. Robertson, and J. O. Johansson, J. Mater. Chem. C 6, 512 (2018).

Der Gast wird betreut von Herrn Prof. Dr. Hübner
Gäste sind herzlich willkommen
Kaffeeausschank ab 17:00 Uhr

Montag, 12. November 2018, 17:15 Uhr
Gebäude 46 / Raum 46-270

TECHNISCHE UNIVERSITÄT KAISERSLAUTERN