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Spin exchange interaction in quasi-1D Cu-phthalocyanine crystalline thin film measured by Magnetic Circular Dichroism (MCD) spectroscopy ZHENWEN PAN, NAVEEN RAWAT, CODY LAMARCHE, Material Science and Physics Dept.,University of Vermont, TAKAHISA TOKUMOTO, National High Magnetic Field Laboratory, ANTHONY WETHERBY, RORY WATERMAN, Chemistry Dept., University of Vermont, RANDY HEADRICK, Material Science and Physics Dept.,University of Vermont, STEVE MCGILL, National High Magnetic Field Laboratory, MADALINA FURIS, Material Science and Physics Dept.,University of Vermont — Highly-oriented Cu-phthalocyanine (PC) pen-written crystalline thin films can be viewed as quasi-1D spin 1/2 magnetic chains. In order to reveal the nature of spin exchange between localized S=1/2 Cu spins, MCD spectroscopy was performed on films with millimeter-sized grains fabricated from a soluble CuPc derivative in magnetic fields up to 10 Tesla at temperatures ranging from 0.4 K to 77K. At T<2K and B<4T the MCD associated with transitions between Q-band π electron states exhibits a non-linear temperature-dependent Brillouin-like increase with magnetic field. For B>4T the MCD evolves linearly with magnetic field, as expected from diamagnetic carbon-based systems. Theoretical modeling[1] of electronic structure and exchange interactions in this system predicts an indirect exchange mechanism mediated by delocalized ligand states. Our MCD measurements identified the states responsible for this exchange.

[1]W. Wu et. al.,PRB 84,024427(2011)

Zhenwen Pan
Material Science and Physics Dept.,University of Vermont

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