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Exchange Mechanisms in Long Range Ordered Thin Film Organic Magnetic Semiconductors[1] N. RAWAT, R. HEADRICK, M. FURIS, Physics Dept and the Material science program, Univ of Vermont, Burlington, VT, S. MCGILL, National High Magnetic Field Lab, Tallahassee, FL, L. KILANSKI, Physics of Semi-magnetic Semiconductors Group, IFPAN, Poland., R. WATERMAN, Chemistry Dept and the Material science program, Univ of Vermont, VT — Magnetic exchange mechanisms in crystalline thin films of Metal Phthalocyanines (M-Pc) are explored using Magnetic Circular Dichroism (MCD) and SQUID measurements up to 10 T and 2K. Long range ordered thin films of organo-soluble derivatives of Co-Pc and Mn-Pc were fabricated using solution processing technique. In the case of Mn-Pc, our measurements show enhanced hybridization of ligand π-electronic states with the Mn d-orbitals. MCD active states beyond 1 μm have been observed for the first time, providing crucial information on the orbital arrangements of MPc's that result in competing (co-existing) long-range superexchange and indirect exchange reminiscent of RKKY. The evolution of Zeeman splitting of specific MCD-active states is very well described by enhanced effective π-electrons g-factors as large as 100, analogous to diluted magnetic semiconductors (DMS) systems. In Co-Pc MCD data indicates a weaker exchange interaction between delocalized charge carriers and d-like spin-polarized electrons, however SQUID measurements reveal magnetic ordering up to 180K. A comparison between Mn-Pc and Co-Pc and earlier results from the spin 1/2 Cu-Pc and their non-magnetic Zn-Pc counterpart, offers an interesting view on the role of long range order in magnetic interactions.

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