

Abstract Submitted
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Metal / Metal - Free Phthalocyanine Crystalline “Alloys”: Organic Analogues to Diluted Magnetic Semiconductors¹ M. FURIS, N. RAWAT, L.W. MANNING, R. HEADRICK, Physics Department and the Material Science Program, Univ. of Vermont, Burlington VT, S. MCGILL, National High Magnetic Field Laboratory, Tallahassee, FL — Magnetic properties of organic crystalline thin films alloys of Phthalocyanines made of a mixture of organo-soluble derivatives of (Co-Pc) and metal-free (H_2Pc) molecules are investigated. Thin films with metal to metal-free Pc ratios ranging from 1:1 to 1:10 are fabricated using a novel solution processing method that produces macroscopic grains with molecules stacked parallel to each other along the crystalline *c*-axis. Magnetic Circular Dichroism (MCD) measurements reveal a substantial enhancement of spin-dependent exchange interactions involving the spin polarized electrons localized on the d-orbitals of cobalt and the delocalized π -electrons, in comparison to the pure Co-Pc films. More importantly, they indicate the presence of a low temperature ferromagnetic state in these films whose characteristics depend on the mixing ratio. We hypothesize this ordered state is caused by an organic analogue of the RKKY mechanism where the delocalized π -electrons play the role of the conduction and/or valence band electrons that mediate and control the sign of exchange between the localized unpaired d-electron spins. This hypothesis is supported by luminescence results that indicate the π -electrons wavefunctions extend over at least two neighboring Co spins.

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Madalina Furis
University of Vermont

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