Unusual features of magnetism in transition-metal-doped phthalocyanines C\textsubscript{32}H\textsubscript{16}N\textsubscript{8}TM (TM = Mn, Fe, Co, Ni, Cu) ZHENGJUN WANG, MOHINDAR S. SEEHRA, Department of Physics and Astronomy, West Virginia University — Transition-metal-doped phthalocyanines (TMPc), semiconductors with potential optoelectronic applications [1], are planar molecules with the TM atom at the center bound to four N atoms and forming a linear chain along the monoclinic b-axis. Because of this symmetry, the ground states of TMPc often violate the Hunds' rules; e.g. the S = 3/2 state for d\textsuperscript{5} Mn(II) in \(\beta\)-MnPc, S = 1/2 state for the d\textsuperscript{7} Co(II) in \(\beta\)-CoPc, and S=0 for Ni(II) in NiPc. The magnetic properties of TMPc are also affected by the stack angle \(\delta\) between the orientation of the molecular plane and the b-axis, \(\delta\) being 65(45) for \(\alpha\) (\(\beta\)) phase [2]. For \(\beta\)-CoPc, our M vs. T data fits well with the Bonner-Fisher model for S = 1/2 AFM Heisenberg linear chain [3] yielding the Co\textsuperscript{2+}-Co\textsuperscript{2+} exchange constant J/k\_B\(\beta\) = - 1.5 K. For \(\beta\)-MnPc, a long-presumed ferromagnet with \(T_C\approx9\) K [4], our magnetic studies show it to be an Ising chain magnet with Arrhenius magnetic relaxation governed by J/k\_B\(\beta\) = 2.6 K and the zero-field splitting D/k\_B\(\beta\) = 8.3 K. In \(\beta\)-MnPc, the absence of \(\lambda\)-type peak in specific heat and no peaks in ac susceptibilities near the quoted \(T_C\approx9\) K confirms the absence of long range order (LRO). Instead we argue that LRO is absent in \(\beta\)-MnPc as D \(>\) J makes the spins in a chain parallel but canted with respect to spins in neighboring chains. [1]G. Mattioli et al, Phys. Rev. Lett. 101, 126805 (2008); [2]Z. Wang et al, IEEE Trans. Mag. 51, 2700104(2015); [3]J. Bonner & M. Fisher, Phys. Rev. 135, A640 (1964); [4]Y. Taguchi et al, J. Magn. Magn. Mater.301, 1229 (2007).

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