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Nature of magnetism in the molecular semiconductor Cobalt Phthalocyanine ($C_{16}H_{32}CoN_8$): Low temperature, high magnetic field investigations Z. WANG, Department of Physics and Astronomy, West Virginia University, M. LEE, E.S. CHOI, Department of Physics and NHMFL, Florida State University, J. POSTON, U.S Department of Energy, NETL, M.S. SEEHRA, Department of Physics and Astronomy, West Virginia University — Transition metal doped phthalocyanines (MPc, M = Mn, Fe, Co, Ni and Cu) are molecular semiconductors with many potential applications in which the M atoms form linear chains along the b-axis [1]. A recent report [2] on β-CoPc based on the temperature dependence (8 K to 310 K) of magnetization (M) in magnetic field H = 70 kOe suggested it to be a linear chain magnet. Here we report results from detailed investigations of the magnetic properties of two powder samples of β-CoPc covering wider temperature range of 0.4 K to 300 K and in H up to 90 kOe. X-ray diffraction confirmed the β-phase and SEM showed needle-like (plate-like) morphology for the samples from Sigma-Aldrich (Alfa-Aesar). Magnetically, both samples are quite similar, the M vs. T data in H = 10 kOe fitting the Curie-Weiss (CW) law above T >3 K yielding θ = 2.5 K, = 2.16 $_B$ per Co^{2+} and g = 2.49 for S = 1/2. Below 3 K, the data deviates from the CW law yielding a peak in M near 2 K, but the data from 0.4 K to 300 K fits well with the prediction of the Bonner-Fisher model for S = 1/2 AFM Heisenberg chain [3] yielding the Co^{2+}-Co^{2+} exchange constant J/k_B = 3 K ($\mathbf{H} = J \Sigma \mathbf{S_i \bullet S_{i+1}}$). [1] A. Mugarza et al, Phys. Rev. B. 85, 155437, (2012); [2] M. Serri et al, Nature. Commun. **5,** 3079 (2014); [3] J. Bonner and M. Fisher, Phys. Rev. 135, A640 (1964).

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