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Crystal Structure and Magnetic Properties of an oxygen deficient n = 2 Ruddlesden-Popper phase $Sr_3Co_2O_{5.67}$ JULIENNE M. HILL, JOHN F. MITCHELL, Materials Science Division, Argonne National Laboratory, Argonne, IL 60439, BOGDAN DABROWSKI, Department of Physics, Northern Illinois University, DeKalb, IL 60115 — Interest in charge, orbital, and spin state phenomena in perovskite and related cobalt oxides is a growing area of transition metal oxide physics. Recently, J. Matsuno *et al.*[1] have found that epitaxial films of the n = 1 Ruddlesden-Popper (R-P) phase Sr_2CoO_4 are metallic ferromagnets with relatively high $T_C \sim 250$ K. This is particularly interesting in light of the formal oxidation state of Co, Co^{4+}, offering no clear source of carriers. To extend the materials chemistry and physics of the R-P series of cobaltites, we have synthesized the n = 2 R-P phase $Sr_3Co_2O_{7-\delta}$ in bulk form. The crystal structure [from neutron powder diffraction (NPD) data] of our most oxygen-deficient sample, $Sr_3Co_2O_{5.67}$ is orthorhombic *Immm* with a = 3.94025(9) Å, b = 3.67479(9) Å and c = 20.6642(5) Å. The magnetization versus temperature data show two antiferromagnetic transitions at approximately 170 K and 220 K. To further elucidate the magnetic properties of this material, we have conducted a temperature-dependent NPD study. The low temperature magnetic structure is surprisingly complex and suggestive of an incommensurate ordering wave vector. Full details and results of the NPD study will be given.

[1]J. Matsuno *et al.*, PRL **93**, 167202 (2004).

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