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Structural and Magnetic Behavior of a New Low Dimensional Cobalt Oxide JOHN MITCHELL, HONG ZHENG, Argonne National Laboratory, LAURENT CHAPON, PAOLO RADAELLI, ISIS Facility, Rutherford Laboratory — The study of transition metal oxide physics has been dominated by octahedral coordination of the transition metal, such as in perovksite manganites and cobaltites. A less common coordination geometry is the tetrahedron, whose weaker crystal field [10 Dq (tetrahedron) = 4/9 10 Dq (octahedron)] favors high-spin complexes across the periodic table. Here we discuss the crystal and magnetic structure of a recently-identified class of tetrahedrally coordinated mixed-valent cobalt oxides, $RBaCo_4O_7$ (R=Y, Tm, Yb, Lu). The structure of these compounds consists of planes of corner-sharing CoO_4 tetrahedra that form a Kagome net when considering only the Co ions. These planes are connected in the third dimension by yet another CoO_4 tetrahedral layer with a density 1/3 that of the Kagome plane. A full temperature-dependent neutron diffraction study on the Yb compound reveals a structural phase transition from trigonal ($P31c$) to monoclinic (Cc) on cooling through T=180 K. This first order transition is accompanied by an anomaly in the magnetization and a pronounced increase in resistivity. Below 75 K, broad superlattice lines appear. We discuss these findings in terms of Co spin states, the possibility of charge order of the Co^{2+} and Co^{3+} ions (formally a 3:1 ratio Co^{2+}/Co^{3+}), and low-dimensional magnetism engendered by the crystal structure.

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