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Ionic Size Effects and Magnetic Incommensurability in Cobaltite
JUAN YU, DESPINA LOUCA, Physics Department, UVA, DANIEL PHELAN, NIST, K. YAMADA, Institute of Materials Research, Tohoku University — $LaCoO_3$ in which Co^{3+} has nearly degenerate spin states shows unusual magnetic behavior attributed to the fact that the different states can co-exist. The cobalt ions interact with each other via complex magnetic coupling, that is further complicated by the addition of Co4+ ions with hole doping. In the case of hole doped $La_{1-x}Sr_xCoO_3$ (LSCO), we found that the system exhibits a rich phase diagram, dominated by two competing magnetic phases, one that is ferromagnetic and metallic and another that is incommensurate with the lattice and insulating. Our recent elastic neutron scattering measurements on single crystals of $La_{1-x}Ba_xCoO_3$ (LBCO, with x = 0.03, 0.06, 0.10 and 0.15) also identified the coexistence of these two phases. Compared to LSCO, the LBCO series shows different incommensurability, but has a similar trend in the progression of intensity with increasing x. However, the LBCO series shows a much longer correlation length particularly in the direction perpendicular to (111), and a significantly stronger incommensurate peak than in LSCO. The incommensurate and ferromagnetic-like intensities exhibit identical temperature dependence in LBCO unlike in LSCO, in which ferromagnetic scattering had a higher onset temperature than the incommensurate phase at identical compositions.

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