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**Doped Perovskite Cobaltites: Phase Separation and
Intergranular GMR**

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ABSTRACT

Magneto-electronic phase separation, where a chemically homogeneous material displays spatial coexistence of multiple magnetic and electronic phases, is very common in perovskite oxides and is thought to play a key role in high temperature superconductivity and colossal magnetoresistance. The oxide materials that display this phenomenon have been observed to form states composed of ferromagnetic clusters in a non-ferromagnetic matrix, as a simple example. We have used a battery of complementary experimental techniques to tackle the problem of magnetoelectronic phase separation in the perovskite cobaltite $\text{La}_{1-x}\text{Sr}_x\text{CoO}_3$. This is a material that offers many of the desirable attributes of a model system for investigating phase separation. Co NMR and small angle neutron scattering unequivocally demonstrate the existence of magnetoelectronic inhomogeneity in samples that are proven chemically homogeneous on nm length scales by scanning TEM. At low doping ferromagnetic metallic clusters form in an insulating matrix. These clusters coalesce with increasing doping, leading to a percolation transition and the onset of long-range ferromagnetic order. In single crystals, this formation of isolated clusters leads to a hysteretic negative MagnetoResistance (MR), which has field, temperature, and doping dependencies consistent with an intergranular Giant MagnetoResistance (GMR) effect. We argue that this system is a naturally forming analog to the artificial structures fabricated by depositing nanoscale F particles in a metallic or insulating matrix, *i.e. this material displays an intergranular GMR effect without the deliberate introduction of chemical interfaces.*