Magneto-electronic Phase Separation in Pr$_{1-x}$Ca$_x$CoO$_{3-\delta}$: Intrinsic Exchange Spring Magnetism$^1$ S. EL-KHATIB, American University of Sharjah, S. BOSE, C. HE, J. KUPLIC, University of Minnesota, M. LAVER, J.A. BORCHERS, Q. HUANG, J.W. LYNN, NIST Center for Neutron Research, J.F. MITCHELL, Argonne National Laboratory, C. LEIGHTON, University of Minnesota — We present a neutron diffraction, small-angle scattering, and magnetometry study of the narrow bandwidth perovskite cobaltite Pr$_{1-x}$Ca$_x$CoO$_3$, demonstrating an unusual form of magneto-electronic phase separation where long-range ordered ferromagnetism coexists spatially with short-range ferromagnetism. The two phases have very different coercivities and, remarkably, are strongly exchange coupled. The electronic phase separation thus leads to spontaneous formation of a hard-soft nanocomposite, exhibiting prototypical exchange-spring behavior in the absence of chemical interfaces.

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