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New magnetic states in Na_xCoO_2 induced by controlled Na order. T. F. SCHULZE, P. S. HAEFLIGER, Laboratory for Solid State Physics, ETH Zurich, CH-8093 Zurich, Switzerland, CH. NIEDERMAYER, Laboratory for Neutron Scattering, ETH Zurich and Paul Scherrer Institute (PSI), CH-5232 Villigen, Switzerland, K. MATTENBERGER, S. BUBENHOFER, B. BATLOGG, Laboratory for Solid State Physics, ETH Zurich, CH-8093 Zurich, Switzerland — We prove the direct link between low temperature magnetism and high-temperature Na^+ ordering in Na_xCoO_2 using the example of a so far unreported magnetic transition at 8K . The new magnetic state carries a weak ferromagnetic moment parallel to the CoO_2 layers. The 8K feature has been characterized in detail and its dependence on a diffusive Na+ rearrangement around 200K is demonstrated. The diffusive process is found to slow down around 200K, and the characteristic time scale reaches several hours at 195K. Applying muons as local probes this process is shown to result in a reversible phase separation into distinct magnetic phases that can be controlled by specific cooling protocols. Thus the impact of ordered Na+ Coulomb potential on the itinerant electrons in the CoO_2 layers is evident, and new ways to experimentally revisit the Na_xCoO_2 phase diagram are discussed.

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