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Na ordering imprints a metallic kagomé lattice onto the Co planes of Na2/3CoO2

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Abstract

We report 23Na and 59Co nuclear magnetic (NMR) and quadrupolar resonance (NQR) studies for the x=2/3 phase of the lamellar oxide NaxCoO2, which allowed us to establish reliably the atomic order of the Na layers and their stacking between the CoO2 slabs. We evidence that the Na+ order stabilizes filled non-magnetic Co 3+ ions on 25% of the cobalt sites arranged in a triangular sublattice. The transferred holes are delocalized on the 75% complementary cobalt sites which unexpectedly display a planar cobalt kagomé structure. These experimental results resolve a puzzling issue by precluding localized moments pictures for the magnetic properties. They establish that the quasi-ferromagnetic properties result from a narrow band connecting a frustrated arrangement of atomic orbitals, and open the route to unravel through similar studies the electronic properties of the diverse ordered phases of sodium cobaltates.

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