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Charge ordering and magneto-polarons in Na_xCoO_2

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Using spectral ellipsometry, we measured the dielectric function of a Na_xCoO_2 single crystals. In particular, we investigated samples with $x > 0.75$ that exhibit bulk AF with $T_N = 20\text{K}$. We identify two prominent transitions in the optical response as a function of temperature. The first one at 260-280 K involves marked changes of the electronic and lattice responses that are indicative of charge ordering. Besides the formation of a very narrow Drude-peak we observe a strong collective mode and the formation of a pseudogap with a large energy scale of about 0.5 eV. The second transition occurs at T_N , it also involves a surprisingly large energy scale of about 0.4 eV and gives clear evidence for a strong spin-charge coupling. The data are discussed in terms of charge ordering and formation of magneto-polarons due to a charge-induced spin-state transition of adjacent Co^{+3} ions.

C.Bernhard et al., PRL 93, 167003 (2004)