Peculiarities of spin and charge degrees of freedom in strongly correlated layered cobaltates

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The layered cobaltate systems stand for the rare case of metallic quasi-2D triangular lattices at doping $x$. While $x=0$ corresponds to a half-filled scenario, $x=1$ marks the band-insulating limit. Surprisingly, the phase diagram displays especially for $x > 0.5$ a rich competition between different spin-orderings as well as intriguing charge-ordering processes. Though already at high doping, strong electronic correlations are mainly responsible for the complex physics [1-4]. By means of combinations of band-structure techniques with many-body approaches it is shown that various cobaltate features may be tackled successfully. For instance the in-plane crossover from antiferromagnetic spin correlations towards the onset of ferromagnetism as well as charge ordering tendencies favoring an effective kagome lattice close to $x=0.67$ in agreement with experiment. The charge order also substantially affects the spectral and transport properties, giving rise to a specific low-energy scale susceptible to nonlocal correlations.