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Charge and Spin Order in $Na_0.5CoO_2$[1] TING-PONG CHOY, PHILIP PHILLIPS, University of Illinois — Several experimental puzzles surround the insulating state of $Na_0.5CoO_2$: 1) antiferromagnetic order is observed but with a reduced moment $\mu_B = 0.25$, 2) the insulating state occurs at a temperature below which Néel order obtains, and 3) static charge ordering is not seen in all NMR experiments. To address these questions, we focus on controlled calculations of the spin-wave spectrum and the magnitude of the local moment in two of the models proposed for the insulating state: 1) a charge-ordered state with 4-fold symmetry and 2) charge-ordering state with only 2-fold symmetry. We present a detailed isospin/spin coupling model which demonstrates how the charge and spin order are coupled. The phase diagram suggests that the ground state of $Na_0.5CoO_2$ should be both charge and spin ordered. Serveral candidates with different ordering are studied under a generalized spin-wave theory. By comparing the Neutron results with the low energy excitaion and the calculated structure factor, we conclude that the ground state of $Na_0.5CoO_2$ is charge with 4-fold symmetry and long-range spin order. In this state, we find that a spin moment of $\mu_B = 0.25$ is well described by the experimentally relevant parameters for the exchange couplings.

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