Charge/Orbital Ordered Phases of $\text{La}_{2-2x}\text{Sr}_{1+2x}\text{Mn}_2\text{O}_{7-\delta}$

KEN-NETH GRAY, HONG ZHENG, QING’AN LI, JOHN MITCHELL, Argonne National Laboratory — Our studies have significantly modified the conventionally-held view of the phase diagram of $\text{La}_{2-2x}\text{Sr}_{1+2x}\text{Mn}_2\text{O}_{7-\delta}$ for two compositions exhibiting charge (and orbital) order (CO), i.e., at hole doping levels, $h=x-\delta$, of $\sim0.5$ and $\sim0.6$. These CO states are stable over very narrow doping ranges ($\Delta h\sim\pm0.005$) at the lowest temperatures, but those ranges increase at higher temperatures (to $\Delta h\sim\pm0.02$) in a manner consistent with simple entropy considerations. Such narrow ranges dictate the crucial need for crystal homogeneity. Attesting to such homogeneity is a conductivity ratio of $>10^{10}$ upon crossing the first-order phase boundary from CO at $h=0.60$ to AAFM at $h\sim0.59$ or $h\sim0.61$ plus two findings that were missed in the existing literature: that these CO phases are the ground state at the lowest temperatures and, for $h\sim0.5$, that coexistence of the CO and AAFM phase is absent at any temperature.

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