Antiferromagnetism in CaAl$_2$Si$_2$-type CaMn$_2$As$_2$ and SrMn$_2$As$_2$ single crystals

N. S. SANGEETHA, ABHISHEK PANDEY, ZACKERY A. BENSON, D. C. JOHNSTON, Ames Laboratory, Department of Physics and Astronomy, Iowa State University, Ames, Iowa 50011 — Magnetic susceptibility versus temperature $\chi(T)$ measurements of CaMn$_2$As$_2$ and SrMn$_2$As$_2$ crystals show clear antiferromagnetic (AFM) transitions at $T_N \approx 65$ K and 120 K, respectively. The anisotropic behaviors in $\chi(T \leq T_N)$ suggest that both compounds are noncollinear antiferromagnets which may result either from an intrinsic noncollinear structure or from multiple collinear AFM domains that are not aligned collinearly. The $\chi(T)$ data at $T > T_N$ reveal that both compounds exhibit strong short-range AFM ordering, evidently associated with quasi-two-dimensional spin lattices. The electrical resistivities show insulating ground states with activation energies of $\approx 63$ meV in CaMn$_2$As$_2$ and 44 meV in SrMn$_2$As$_2$. The experimental results thus reveal that both (Ca, Sr)Mn$_2$As$_2$ materials are AFM insulators at low temperatures and in analogy with the high $T_c$ cuprates, may be potential parent compounds for CaAl$_2$Si$_2$-type superconductors.

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