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Low-Electric-Field Tuned Impurity Conduction in Antiferromagnetic Manganites[1] CORNELIU CHIORESCU, JOSHUA COHN, University of Miami, JOHN NEUMEIER, Montana State University — Transport measurements for temperatures in the range 4.2 K $\leq T \leq$ 300 K are reported for the semiconducting, antiferromagnetic manganites $SrMnO_3$ and $CaMnO_3$. At low T where impurity conduction predominates, the electrical conductivity and Hall coefficient are found to be strongly electric-field dependent. For $SrMnO_3$, the mobile carrier density is continuously tunable over a range of more than three orders of magnitude in electric fields $F \leq 50$ V/cm. The conductivity and carrier density scale with field $\propto \exp(\sqrt{F})$, indicating Poole-Frenkel field-assisted ionization of bound carriers. The binding energy for $SrMnO_3$ ($\delta \sim 3.5$ meV) implies that electrons are ionized to more mobile states within the energy gap, rather than to the conduction band. This small energy scale correlates with the low-temperature onset of a small ferromagnetic moment in this compound, suggesting that bound electrons form ferromagnetic polarons. Strong electron correlation effects are suggested by the electric-field dependent Hall mobility.

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