Manganite based Field Effect Transistor:
New Materials Science ⇔ new device potential

The transistor (resistivity controlled by gate voltage) is basic to modern technology, and for 50 years the material of choice has been silicon. But as device dimensions shrink to the nanometer scale, silicon’s low carrier density creates problems.

New materials and new control methods are needed!

We found: large field effects in La$_{0.7}$Ca$_{0.3}$MnO$_3$, a ‘colossal’ Magnetoresistance Manganite

Key feature: electronic phase coexistence (EPC),

Electric field effect (curve A→curveB):
a small voltage (~ 6 volts across ~15 nm dielectric/ferroelectric) cuts resistivity of La$_{0.7}$Ca$_{0.3}$MnO$_3$ in half;

Magnetic field effect (curve A→curve C):
A large ~ 6 Tesla magnetic field is needed to cut resistivity of La$_{0.7}$Ca$_{0.3}$MnO$_3$ in half.


EPC shown by our MRSEC in Bulk and Thin Films under strain