Abstract Submitted
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Electric field effect near the metal-insulator transition of a two-dimensional electron system in $SrTiO_3$[1] KAVEH AHADI, OMOR SHORON, PATRICK MARSHALL, EVGENY MIKHEEV, SUSANNE STEMMER, Univ of California - Santa Barbara, STEMMER RESEARCH GROUP TEAM — We report on the effects of electric field on the two-dimensional electron gas at the $SmTiO_3/SrTiO_3$ interface. Reducing the thickness of the $SmTiO_3$ depletes a significant fraction of the two-dimensional electron gas and drives it into the vicinity of a temperature-triggered metal insulator transition (257 K). After gate metal deposition, the sheet resistance exceeds the quantum resistance, h/e^2, and the $SrTiO_3$ channel is in the hopping regime at zero gate bias. We show that electric field effect can be used to tune the two-dimensional electron system in $SrTiO_3$ that is deep in the insulating phase (R_s >380 kΩ/) to near the transition to a metal, which occurs at the quantum limit, R_s ~h/e^2. Saturation current densities and sheet resistance modulation cannot solely be explained by carrier density modulation, which was independently confirmed using capacitance-voltage measurements, indicating a change in the nature of transport as a function of electric field. The channel resistances as a function of temperature can all be scaled by a single parameter, which depends on the gate bias, similar to two-dimensional electron systems in high-quality semiconductors.

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