Coexisting ferroelectricity and diode effect in superconducting $LaAlO_3/KTaO_3$ interface

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In the talk we will briefly present two interesting observations at $LaAlO_3/KTaO_3$ interfaces. The first is the coexistence of ferroelectricity and superconductivity. Our experiments show a universal enhancement of the superconducting transition temperature (T_c) by 0.2–0.6 K, accompanied by bistable transport hysteresis that indicates switchable ferroelectric polarization in the interfacial conducting layer. Raman spectroscopy and hysteresis loops confirm ferroelectricity below 50 K. The T_c enhancement is attributed to ferroelectric-polarization-induced reduction in dielectric constant, which narrows the interfacial potential well and confines carriers closer to the interface. The bistability arises from switchable ferroelectric polarization, which modulates the potential well depending on polarization direction.

The second observation is the superconducting diode effect (SDE). We observe a strong SDE in Hall-bar devices, with rectification efficiencies up to 40% and output signals exceeding 10 mV at 0.3 K. Using conductive atomic force microscope lithography, we demonstrate reversible nanoscale editing of the SDE's polarity and efficiency by locally modifying the edges of the superconducting channel.