Superconducting properties of single and bilayer LaAlO$_3$/SrTiO$_3$ interfaces$^1$ STEFANO GARIGLIO, ALEXANDRE FETE, DANFENG LI, WEI LIU, MARGHERITA BOSELLI, DQMP, University of Geneva, NICOLAS REYREN, Unite Mixte de Physique CNRS-Thales, JEAN-MARC TRISCONE, DQMP, University of Geneva — The two-dimensional electron liquid present at the LaAlO$_3$/SrTiO$_3$ interface exhibits superconductivity and hosts a large spin-orbit interaction. Quite remarkably, both phenomena can be controlled by an electric field. In this work, we have mapped the evolution of the superconducting properties upon gate voltage tuning, revealing a surprising change in thickness of the superconducting layer across the phase diagram. Using a single LaAlO$_3$/SrTiO$_3$ interface, we have realized field effect transistors and estimated the characteristic lengths (the coherence length and the superconducting thickness) as a function of the gate voltage by measuring the critical magnetic fields in parallel and perpendicular geometry. We have also realized bilayer interfaces, where two superconducting liquids are separated by the LaAlO$_3$ layer. In such structures, we have investigated the possible coupling of the two superconducting sheets, tuning one of the two by electric field.

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