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Effect of Stoichiometry on the Two-Dimensional Electron Gas at the $LaAlO_3/SrTiO_3$ Interface Grown by MBE. MAITRI WARUSAWITHANA, CHARLES BROOKS, DARRELL SCHLOM, Cornell University, STEFAN THIEL, JOCHEN MANNHART, University of Augsburg, NICOLAS REYREN, ANDREA CAVIGLIA, STEFANO GARIGLIO, JEAN-MARC TRISCONE, University of Geneva — The discovery of a quasi 2-dimensional electron gas (q2-DEG) at the interface between $SrTiO_3$ and $LaAlO_3$ has enabled a number of exciting developments. So far this q2-DEG has been observed only in films grown by pulsed-laser deposition, which raised a question as to whether this manifestation has a connection with defects that result from the dynamics of the growth scheme employed. We find that a q2-DEG can also be obtained using the more gentle growth technique, molecular-beam epitaxy, and that control of the stoichiometry of the $LaAlO_3$ layer is key to its existence. Small changes in the composition of the $LaAlO_3$ layer affect the conductivity at the heterointerface. With appropriate stoichiometry the electron gas transitions into a superconducting state below $\sim$200 mK. Interesting possibilities that stem from these findings of composition control on conductivity and the ability to obtain this q2-DEG under the framework of molecular-beam epitaxy will be discussed.

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