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Depth dependence of charge density and orbital symmetry at the $\text{LaAlO}_3/\text{SrTiO}_3$ interface from resonant x-ray reflectometry ROBERT GREEN, GEORGE SAWATZKY, University of British Columbia — The interface between the insulators LaAlO_3 and SrTiO_3 is known to accommodate a two-dimensional electron liquid (2DEL)—a high mobility electron system which exhibits superconductivity, magnetism, and correlations. While this flagship oxide heterostructure shows promise for electronics applications, questions remain regarding the origin and microscopic properties of the 2DEL, largely because the electronic structures of such buried interfaces are inherently difficult to probe. Here we utilize resonant x-ray reflectivity to perform a comprehensive examination of the 2DEL. We discover a high charge density near 0.5 electrons per interfacial unit cell for samples above the critical LaAlO_3 thickness, a quantity predicted by theory but previously elusive in experiments, and extract the spatial profile of both the orbital and electronic reconstructions. We additionally study effects of post-annealing treatments in oxygen environments on the electronic and atomic structures near the interface. Our results provide insights into this often controversial interface, and show resonant x-ray reflectometry to be an ideal tool for the study of oxide heterostructure phenomena.

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