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Spatial Charge Distribution in the $LaAlO_3$-$SrTiO_3$ Interface Measured by Angle Resolved Soft X-ray Absorption A. ARIANDO, A. RUSYDI, X. WANG, T. VENKATESAN, NanoCore, National University of Singapore, J. HUIJBEN, H. HILGENKAMP, University of Twente, J. C. LEE, S. SMADICI, P. ABBAMONTE, Brookhaven National Laboratory and University of Illinois — At the interface between complex insulating oxides, novel phases with interesting properties occur. In particular, studies have recently shown high-mobility two-dimensional conducting planes emerge at the interface between insulating oxide heterostructures of $LaAlO_3$ and $SrTiO_3$. Although this state has been predicted and reported to be confined at the interface, transport studies alone cannot measure the charge distribution since mobility may also vary spatially. A way to measure the charge distribution independent of mobility is needed. Here, we present for the first time a direct mapping of the spatial charge density distribution of this system through oxygen vacancy mapping about the interface between $LaAlO_3/SrTiO_3$ layers prepared at various oxygen deposition partial pressures using angle resolved soft x-ray absorption. We find that, depending on specific growth protocols, the spatial extension of the oxygen vacancies (charges) can be varied from a 3d-like to a 2d-like distribution at the $LaAlO_3/SrTiO_3$ interface.

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