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Electronic Orbital Reconstruction at (110)-oriented $LaAlO_3/SrTiO_3$ interfaces GERVASI HERRANZ, DAVID PESQUERA, MATEUSZ SCIGAJ, NICO DIX, FLORENCIO SANCHEZ, JOSEP FONTCUBERTA, Institute of Materials Science of Barcelona ICMAB-CSIC, PIERLUIGI GARGIANI, JAVIER HERRERO, ERIC PELLEGRIN, MANUEL VALVIDARES, CELLS-ALBA Synchrotron Radiation Facility, Cerdanyola, Spain, ALESSANDRO BARLA, Istituto di Struttura della Materia, ISM CNR, Trieste, Italy, RUBEN WEHT, Comision Nacional de Energia Atomica (CNEA), San Martin, Argentina — About ten years ago, a two-dimensional gas (2DEG) was discovered at the interface between two insulators: $SrTiO_3$ (STO) and $LaAlO_3$ (LAO). Later on, superconductivity as well magnetism were reported, making the LAO/STO interface an extremely intriguing system. So far the research was essentially directed to the (001)-interface, along which a built-in electrostatic potential is thought to generate the 2DEGs. Recently, however, high-mobility 2DEGs have been discovered along other directions, including <110>for which such a built-in potential was unexpected. Yet, a direct fingerprint of the distinctive nature of the electronic structure at the (110)- interface has not been provided. Here, based on X-ray linear dichroism (XLD) experiments we show explicitly the dissimilar hierarchy of the electronic states at the (001)- and (110)- interfaces. In particular, our XLD experiments demonstrate that the degeneracy is fully removed in the t_{2g} and the e_g levels. Contrary to (001)- interfaces –where the first accessible orbitals are dxy–, our DFT calculations show, in agreement with XLD, a very strong contribution of the dxz/dyz orbitals at the first available levels in energy at (110)-interfaces.

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