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Key to formation of two-dimensional electron gas and two-dimensional superconductivity at $LaAlO_3/SrTiO_3$ YINLONG HAN, SHENGCHUN SHEN, CHENGJIAN LI, ZHONGZHONG LUO, GUOLIANG QU, JIACAI NIE, Department of Physics, Beijing Normal University, JIACAI NIE TEAM — In this report, we systematically studied the band alignment and interfacial atomic structure of (110) $LaAlO_3/SrTiO_3$ (LAO/STO) interfaces. We show that for both (110) and (001) LAO/STO heterojunctions, the intrinsic or extrinsic coexistence of La and Ti in ABO_3 perovskite unit cells at the interface reduces the valence of Ti, generating a local field and further leading to band bending of the STO. The free electrons would be trapped in the bended conduction band forming 2DEG. This opens new insight of band engineering for controlling the behavior of complex oxide heterojunctions. Besides,the two dimensional superconductiviy of (110) LAO/STO samples is demonstrated based on the systematical transport measurements. The two dimensional characteristics of the superconductiviy is confirmed by analying the Berezinskii-Kosterlitz-Thouless transition. The estimated superconductive thickness is about 18 nm. This discovery may inspire a new round of upsurge on study of LAO/STO interfaces.

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