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Tunable anomalous orbital structure in a spinel-perovskite interface γ-Al_2O_3/$SrTiO_3$[1] YANWEI CAO, XIAORAN LIU, Rutgers University, PADRAIC SHAFER, Lawrence Berkeley National Laboratory, SRIMANTA MIDDEY, University of Arkansas, DEREK MEYERS, Brookhaven National Laboratory, MIKHAIL KAREEV, Rutgers University, ZHICHENG ZHONG, Max-Planck-Institut fur Festkorperforschung, JONG-WOO KIM, PHILIP RYAN, Argonne National Laboratory, ELKE ARENHOLZ, Lawrence Berkeley National Laboratory, JAK CHAKHALIAN, Rutgers University — In all archetypical reported (001)-oriented perovskite heterostructures, for example $LaTiO_3/SrTiO_3$, $LaAlO_3/SrTiO_3$, $YTiO_3/SrTiO_3$ and so on, it has been deduced that the preferential occupation of two-dimensional electron gases is in-plane d_{xy} state. In sharp contrast to this, the investigated electronic structure of a spinel-perovskite heterostructure γ-$Al_2O_3/SrTiO_3$ by resonant soft X-ray linear dichroism, demonstrates that the preferential occupation is in out-of-plane d_{xz}/d_{yz} states for interfacial electrons. Moreover, the impact of strain further corroborates that this anomalous orbital structure can be linked to the altered crystal field at the interface and symmetry breaking of the interfacial structural units. Our findings provide another interesting route to engineer emergent quantum states with deterministic orbital symmetry.

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