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High Mobility Electron Systems at Multipolar Oxide Interfaces GIORDANO MATTONI, Kavli Institute of Nanoscience, Delft University of Technology, Netherlands, ALESSIO FILIPPETTI, CNR-IOM UOS Cagliari, S.P. Monserrato-Sestu Km.0,700, Monserrato (Ca) 09042, Italy, NICOLA MANCA, NILS VERHAGEN, Kavli Institute of Nanoscience, Delft University of Technology, Netherlands, PAVLO ZUBKO, University College London, London Centre for Nanotechnology, UK, ANDREA D. CAVIGLIA, Kavli Institute of Nanoscience, Delft University of Technology, Netherlands — Polar interfaces in complex oxides heterostructures constitute a unique playground for 2D electron systems (2DES), where exotic properties such as superconductivity and magnetism can arise from combinations of bulk insulators. Structural compatibility of these materials allows to build heterostructures where different polar fields can interact to induce novel electronic states. In this work, we investigate the metallic state arising in the $SrTiO_3/LaAlO_3/WO_3$ multipolar interface. Our measurements uncover a thickness-dependent transition from an insulating to a metallic state with electron mobilities up to 80,000 cm^2/Vs. Low-temperature magnetotransport reveals a strong magnetoresistance reaching 1000% at 10T and 1.5K, accompanied by non-linear Hall effect and quantum oscillations of conductance. Our results show how interfaces with multipolar character allow large flexibility in the design of the confinement potential, opening new possibilities for 2DES in strongly correlated materials.

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