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Probing 1D superlattices at the $LaAlO_3/SrTiO_3$ interface[1] M. BRIGGEMAN, M. HUANG, A. TYLAN-TYLER, P. IRVIN, J. LEVY, University of Pittsburgh, J.-W. LEE, H. LEE, C.-B. EOM, University of Wisconsin - Madison — Complex oxides and other quantum systems exhibit behavior that is currently too complex to be understood using analytic or computational methods. One approach is to use a configurable quantum system whose Hamiltonian can be mapped onto the system of interest. This approach, known as quantum simulation, requires a rich physical system whose quanta and interactions can be controlled precisely, at the level of single electrons and other degrees of freedom. Here we describe steps toward developing a quantum simulation platform, using the complex oxide heterostructure $LaAlO_3/SrTiO_3$, by creating quantum systems with features comparable to the mean spacing between electrons[2]. This interface has strong, sign changing, gate-tunable electron-electron interactions [3] that can strongly influence the quantum ground state. We explore the magnetotransport properties of 1D superlattices, where periodic modulation produces reproducible dispersive features not seen in control structures. The results of these experiments can be compared with effective 1D model Hamiltonians to bridge experiment and theory and enable quantum simulation of more complex systems.

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