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Dissipationless transport of spin-polarized electrons and Cooper pairs in an electron waveguide[1] J. LEVY, A. ANNADI, S. LU, G. CHENG, A. TYLAN-TYLER, M. BRIGGEMAN, M. TOMCZYK, M. HUANG, D. PEKKER, P. IRVIN, Univ of Pittsburgh, H. LEE, J.-W. LEE, C.-B. EOM, Univ of Wisconsin-Madison — Electron systems undergo profound changes in their behavior when constrained to move along a single axis. To date, clean one-dimensional (1D) electron transport has only been observed in carbon-based nanotubes and nanoribbons, and compound semiconductor nanowires. Complex-oxide heterostructures can possess conductive two-dimensional (2D) interfaces with much richer chemistries and properties, e.g., superconductivity, but with mobilities that appear to preclude ballistic transport in 1D. Here we show that nearly ideal 1D electron waveguides exhibiting ballistic transport of electrons and non-superconducting Cooper pairs can be formed at the interface between the two band insulators $LaAlO_3$ and $SrTiO_3$. The electron waveguides possess gate and magnetic-field selectable spin and charge degrees of freedom, and can be tuned to the one-dimensional limit of a single spin-polarized quantum channel. The strong attractive electron-electron interactions enable a new mode of dissipationless transport of electron pairs that is not superconducting. The selectable spin and subband quantum numbers of these electron waveguides may be useful for quantum simulation, quantum informatio

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