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1D quantum simulation using a solid state platform[1] MEGAN KIRKENDALL, PATRICK IRVIN, MENGCHEN HUANG, JEREMY LEVY, University of Pittsburgh, HYUNGWOO LEE, CHANG-BEOM EOM, University of Wisconsin - Madison — Understanding the properties of large quantum systems can be challenging both theoretically and numerically. One experimental approach–quantum simulation–involves mapping a quantum system of interest onto a physical system that is programmable and experimentally accessible. A tremendous amount of work has been performed with quantum simulators formed from optical lattices; by contrast, solid-state platforms have had only limited success. Our experimental approach to quantum simulation takes advantage of nanoscale control of a metal-insulator transition at the interface between two insulating complex oxide materials[2]. This system naturally exhibits a wide variety of ground states (e.g., ferromagnetic, superconducting) and can be configured into a variety of complex geometries. We will describe initial experiments that explore the magnetotransport properties of one-dimensional superlattices with spatial periods as small as 4 nm, comparable to the Fermi wavelength. The results demonstrate the potential of this solid-state quantum simulation approach, and also provide empirical constraints for physical models that describe the underlying oxide material properties.

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[2]C. Cen *et al.*, Nat. Mater. **7**, 298 (2008)

Megan Kirkendall
University of Pittsburgh

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