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One-dimensional hole gas in Ge/Si nanowire heterostructures WEI LU, JIE XIANG, BRIAN TIMKO, YUE WU, CHARLES LIEBER, Department of Chemistry and Chemical Biology, Harvard University — Two-dimensional (2D) electron and hole gas systems have played a central role in condensed-matter physics research, as well as high performance electrical and optical devices. In this talk, I will discuss a one-dimensional (1D) hole gas system based on a germanium/silicon core/shell nanowire heterostructure. At room temperature, hole accumulation in the intrinsic germanium channel was observed due to the valence band offset at the Ge/Si interface. At low temperatures, conductance quantization at values close to that expected of a ballistic conductor was observed, and was attributed to the long mean free path in the hole gas and confinement of the hole gas in the radial direction. These effects showed little temperature dependence and suggested that transport in these small diameter nanowires is ballistic even at room temperature. The demonstration of a 1D hole gas in a flexible nanowire heterostructure opens up a number of possibilities for investigating quantum phenomena in low-dimensional systems, as well as applications in both conventional and quantum computing schemes.

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