## Quantum physics in one dimension using Josephson-junction arrays

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Quantum physics in 1D is remarkably rich, yet even with strong interactions and disorder, surprisingly tractable due to the fact that the low-energy physics of nearly all 1D systems can be cast in terms of the Luttinger liquid. Although there have been many theoretical proposals to use linear chains and ladders of Josephson junctions to create novel quantum phases and innovative electronic devices, only modest progress has been made experimentally. One major roadblock has been understanding the role of disorder in such systems. We present recent experimental results that strongly confirm Luttinger behaviour in our devices, validate the quantum many-body theory of one-dimensional disordered systems, and shed light on the competition between Mott insulator and Bose glass. The Bose glass phase is thought to describe helium-4 in porous media, cold atoms in disordered optical potentials, disordered magnetic insulators, and thin superconducting films. The ubiquity of such an electronic glass in Josephson-junction chains has important implications for their proposed use as a fundamental current standard, which is based on synchronisation of coherent tunnelling of flux quanta (quantum phase slips). We have recently extended our measurements to SQUID chains and ladders, finding quite unexpected and tantalising behaviour.