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Weber blockade in superconducting nanowires[1] TYLER MORGAN-WALL, BENJAMIN LEITH, NIKOLAUS HARTMAN, ATIKUR RAHMAN, NINA MARKOVIC, Johns Hopkins University — Vortices in superconductors are topological excitations that carry quantized magnetic flux and can be viewed as basic degrees of freedom that describe the low-energy states of the system. Here we show that a short superconducting nanowire can behave as a quantum dot for vortices. In the range of magnetic fields in which vortices can enter the nanowire in a single row, we find regular oscillations of the critical current as a function of magnetic field, with each oscillation corresponding to the addition of a single vortex to the nanowire. A charge-vortex dual of the Coulomb-blockaded quantum dot for electrons, the nanowire shows diamond-shaped regions of zero resistance as a function of current and magnetic field, in which the number of vortices is fixed. Besides demonstrating that macroscopic objects such as vortices can behave as fundamental particles, the fine control over critical currents and vortex configurations may prove useful for quantum devices that employ superconducting circuits.

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