A Josephson quantum electron pump

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http://www.nature.com/nphys/journal/vaop/ncurrent/full/nphys2053.html [2]

Mesoscopic charge pumping, a transport mechanism that relies on the explicit time-dependence of some properties of a nanoscale conductor, was envisaged theoretically a few decades ago. So far, nanoscale pumps have been realized only in systems exhibiting strong Coulombic effects, whereas evidence for pumping in the absence of Coulomb blockade has been elusive. A pioneering experiment by Switkes et al. evidenced the difficulty of modulating in time the properties of an open mesoscopic conductor at cryogenic temperatures without generating undesired bias voltages due to stray capacitances. One possible solution to this problem is to use the a.c. Josephson effect to induce periodically time-dependent Andreev reflection amplitudes in a hybrid normal–superconducting system. Here we report the experimental detection of charge flow in an unbiased InAs nanowire embedded in a superconducting quantum interference device (SQUID). In this system, quantum pumping may occur via the cyclic modulation of the phase of the order parameter of different superconducting electrodes. The symmetry of the current with respect to the enclosed magnetic flux and bias SQUID current is a discriminating signature of pumping. Currents exceeding 20 pA are measured at 250 mK, and exhibit symmetries compatible with quantum pumping.

- GEOMDISS [3]
- QIPC [4]