Anyon braiding and quasiparticle Andreev scattering in a mesoscopic “collider”

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Anyons are exotic quasiparticles which can carry a fractional charge of an electron and with an exchange statistics in between that of fermions and bosons. These properties were revealed using quantum point contacts (QPC) in the fractional quantum Hall regime [1,2,3]. We report further noise investigation of anyon physics. Sourcing e/3 anyons at a first QPC, noise measured on a downstream «analyzer» QPC reveals different mechanisms. Setting the analyser to allow e/3 tunneling charges, we reproduce the negative cross-correlations previously observed [2], indicative of a non-trivial anyon exchange phase [2,4,5]. When 1 e charges tunnel across the analyser, the braid phase is predicted to be trivial. Our observation of negative cross-correlations [6] points on a scattering mechanism akin to Andreev reflection at Normal/Superconductor interfaces, as suggested in [7]. Remarkably, in both cases, electrical conduction across the analyzer conserves neither the nature nor the number of quasiparticles, rendering the beam-splitter analogy of a QPC lapsed.

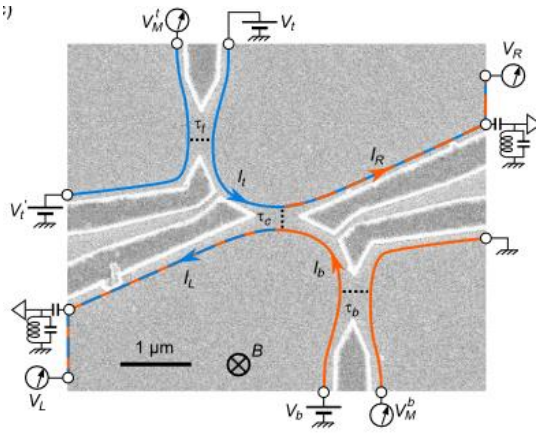

Fig.1. Source-analyzer setup. Quantum point contacts (pairs of facing triangles) at the top left (QPCt) and bottom right (QPCb) in the weak backscattering (WBS) regime constitute sources of quasiparticles of fractional charge e/3. The emitted quasiparticles propagate toward the central analyzer QPCc along quantum Hall edge channels depicted by lines with arrows (inactive channels not shown). Noise cross-correlations inform on the statistics.

References

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