Anyonic exchange in a quantum point contact

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Abstract

Under strong magnetic fields, electrons that are confined to two spatial dimensions can exhibit a fractional quantum Hall state where the elementary particles carry only a fraction of the electron charge. These exotic excitations, called anyons, moreover behave under the interchange of two individuals neither as fermions nor as bosons but are characterized instead by a non-trivial exchange phase. The experimental proof of these anyons and their exchange phase was performed only recently, in 2020. Recent experiments have demonstrated in particular that a quantum point contact on the edge channels of a fractional quantum Hall (Laughlin) state is able to reveal the anyonic phase from noise measurements. Here, we show how the information about braiding governs the output noise correlations. We identify the incoming fractional signal as an environment for the beam splitter with an interference between the two input edge channels. The tunneling at the quantum point contact is triggered by this environment and involves a space-time braiding between the tunneling anyon and the incoming quasiparticles. We also discuss the effect of non-linearity in the tunneling and distinguish it from braiding.

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