Hanbury Brown-Twiss Interferomter in ν=2/5 Fractional Quantum Hall Effect

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The fractional quantum Hall effect (FQHE) provides one of the most celebrated arenas for emergent quasiparticles with fractional charge and anyonic exchange statistics, whose direct detection remains experimentally challenging [2-4]. In conventional Fabry-Pérot and Mach-Zehnder interferometers, single-particle Aharonov-Bohm phases are generally mixed with charge, statistical, and edge-structure effects, obscuring a direct extraction of the statistical angle.

An alternative approach is provided by two-particle interferometry, pioneered in mesoscopic conductors through Hanbury Brown-Twiss (HBT) experiments [5]. Campagnano *et al.* [6] have proposed an anyonic HBT interferometer for a single-mode edge, showing that the cross-correlation of currents can reveal the fractional nature of the tunneling excitations even when single-particle coherence is suppressed. However, the HBT concept has not yet been extended to hierarchical states with multiple co-propagating edge modes. A similar design principle was adopted in MZ setups for the $\nu = 2/5$ Jain state [7]. Extending the HBT geometry to such hierarchical edges thus opens a new route to probing the properties of fractional quasiparticles in multi-mode edge systems.

Motivated by these considerations, we propose a Hanbury Brown-Twiss interferometer built on a $\nu = 2/5$ fractional quantum Hall edge [8]. In contrast to previous FP/MZ schemes, the flux-dependent signal in our geometry arises purely from two-particle interference processes involving tunneling at all four QPCs. We derive an analytic expression for the flux-dependent cross-correlation of the drain currents.

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