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Two-particle indistinguishability interferometry to probe the quantum coherence of anyons

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Anyons are elementary excitations of some topologically ordered quantum phases like the Fractional Quantum Hall liquid which occurs in 2D electronic system in high perpendicular magnetic field. They obey an quantum exchange statistics intermediate between fermions and bosons, hence the name anyons.

Recent experiments have shown evidence of this exotic quantum statistics. However, these experiments do not allow the manipulation of anyons to perform quantum tasks nor to probe their quantum coherence. This requires time-domain manipulation of anyons. In this talk, I will show that creating time-domain e/3 and e/5 anyons is possible and that a novel two-particle interferometry based on their indistinguishability allows probing their quantum coherence. We first demonstrate the creation of time-domain photo-created anyons by observing their signature through a characteristic fractional Josephson relation found in shot noise measurements[1]. Then, a novel interferometry based on Hanbury Brown-Twiss like current noise correlation measurements is shown [2]. The high interference visibility, resulting from two-particle-indistinguishability, reveals a sizable quantum coherence opening the way to future anyon braiding manipulations.

[1] M. Kapfer et al., A Josephson relation for fractionally charged anyons, Science **363**, 846 (2019).
[2] I. Taktak et al., Two-particle time-domain interferometry in the fractional quantum Hall effect regime, Nat. Comm. **13**, 5863 (2022).

Für diese Zeit steht eine Kinderbetreuung nach vorheriger Anmeldung zur Verfügung.

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