Exploring the integer and fractional quantum Hall quasiparticles, beyond fermions and bosons

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Particles in 3D systems are categorized into two classes: fermions or bosons. But low-dimensional systems challenge this standard dichotomy because they can host quasiparticles that exhibit exotic properties including a fractional charge and, most strikingly, inter-exchange (braiding) statistics intermediate between that of fermions and bosons. The corresponding excitations are called “anyons” and two-dimensional electron gas set in the fractional quantum Hall (FQH) effect is an excellent platform to study their unconventional physics. While the fractional charge of such quasiparticles is now firmly demonstrated, revealing their unconventional braiding statistics unambiguously has turned out to be very challenging.

Recently, there has been much attention given to the so-called ‘collider’ approach, involving two symmetric quantum point contacts (QPCs) sources of quasiparticles impinging on a downstream central QPC [1-5]. In this set-up, theory predicts [6-7] that the resulting current cross-correlations between the two outgoing paths ($\langle \delta I_L \delta I_R \rangle$, see Fig.1) inform on the quasiparticles braiding statistics. In this talk, I will present such measurements performed in the integer and fractional quantum Hall regimes and discuss their implications.

I will also present the new project that I plan to develop on this topic, as a newly recruited Maître de conférences, in order to launch a new mesoscopic and quantum transport activity at UCBL.

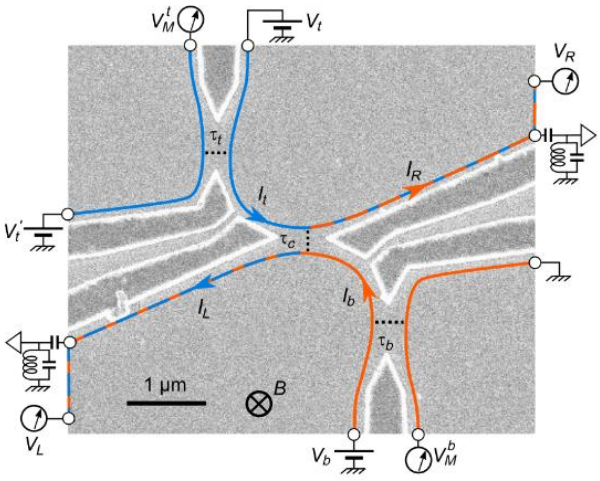

Fig.1. SEM picture of the measured mesoscopic circuit composed of two sources and one central QPCs at ν=1/3

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