Luttinger-liquid behaviour in quantum Hall tunnelling as seen through the tunnelling noise

Tomer Alkalay[1], Noam Schiller[1], Chang-Ki Hong[1], Vladimir Umansky[1], Yuval Oreg[1], Moty Heiblum[1], and Kyrylo Snizhko*[1,2,3]

[1]Weizmann Institute of Science – Israel
[2]CEA-Grenoble – Commissariat à l'Énergie Atomique et aux Énergies Alternatives (CEA) - Grenoble – France
[3]Karlsruhe Institute of Technology – Germany

Abstract

One of the striking predictions of quantum Hall edge theory, alongside the fractional charge and fractional statistics of the quasiparticles, is the power-law dependence of the conductance of a tunnel contact. This power-law dependence is characteristic of Luttinger liquids and is tied to the quasiparticle property called "scaling dimension". Observing this behaviour is known to be problematic both in terms of achieving the qualitatively correct behaviour in experiments and quantitatively matching with theory (1–3).

I will present recent theory (4) that enables extracting the scaling dimension from the Fano factor – building upon the scheme long used to extract the fractional charge. I will further present the analysis of experimental data within this theoretical framework. I will demonstrate how it sheds light on the physics of quantum point contacts in the quantum Hall effect and opens new avenues to investigate renormalization of the Luttinger liquid behaviour.

(1) M. Heiblum, *Quantum Shot Noise in Edge Channels*, Phys. Status Solidi **243**, 3604 (2006).

(2) I. P. Radu, J. B. Miller, C. M. Marcus, M. A. Kastner, L. N. Pfeiffer, and K. W. West, *Quasi-Particle Properties from Tunneling in the $\nu = 5/2$ Fractional Quantum Hall State*, *Science* **320**, 899 (2008).

(3) *S. Baer, C. Rössler, T. Ihn, K. Ensslin, C. Reichl, and W. Wegscheider, Experimental Probe of Topological Orders and E*

(4) *N. Schiller, Y. Oreg, and K. Snizhko, Extracting the Scaling Dimension of Quantum Hall Quasiparticles from Current*

*Speaker