Unexpected visibility asymmetry in the electronic Mach Zehnder interferometer

E. Bieri [1], C. Schoenenberger [1], J. Weis [2], and S. Oberholzer [1]

[1] Department of Physics, University of Basel, Klingelbergstr. 82, CH-4056 Basel, Switzerland
[2] Max-Planck-Institut für Festkörperforschung, Heisenberg Strasse 1, D-70569 Stuttgart, Germany

Interferometer play an important role in the foundation of physics, because the provide deep insight into the quantum nature of matter. In the latter domain, interference of light, electrons, neutrons, helium atoms and even molecules have been studied. Here, we consider a Mach-Zehnder interferometer fabricated into a two-dimensional electron gas [1] and operated in the quantum Hall regime at nu=2. The two ”mirrors” are realized by quantum point-contacts (QPCs). We have studied the visibility of the two path interference as a function of mirror transmission Tm and in the linear and non-linear regime. The visibility follows the expected ”half-circle” dependence on T_m in the linear-response regime and is symmetric with respect to the transformation $T_m => 1 - Tm$ [1,2]. In contrast, this symmetry breaks down at voltages larger than temperature. This effect is quite surprising as it says that the interferometer can distinguish between the input and the output. This effect must has its origin in the interaction between edge-states and in the particular excitation spectrum that affects the inelastic scattering length at finite bias [3].

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