Two-particle interferometry for signal processing of a quantum electrical current

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Important efforts have been made to realize phase-coherent electronics where quantum information can encoded on the electronic degrees of freedom of the electrical current. It is now possible to create and propagate electronic quantum states with finite temporal and energy extensions such that proper tools allowing for a complete state characterization and reconstruction are now needed. We present here the implementation of a tomography protocol in a two dimensional electron gas in the regime of integer quantum Hall effect. The protocol relies on the measurement of two-particle interferences occurring when two sources are placed at the inputs of an electronic beam-splitter. Using a set of known states in one input, it is then possible to reconstruct the unknown state incoming in the other input by measuring the output current fluctuations. Although the protocol can be used to characterize any state, we present here the reconstruction of the Wigner distribution of an edge channel excited with a sinusoidal drive. This creates a few excitations state that, at high frequency, differs from a Fermi sea with a time-varying chemical potential as can be seen from the negative values taken by the Wigner distribution.