

# Characterization of Electronic Entanglement via Photo-Assisted Filtering

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Recent breakthroughs in electron quantum optics have enabled unprecedented control on the generation of quantum electrical currents based on single to few electron excitations [1,2]. These advancements pave the way for high precision applications, ranging from time resolved sensing of electromagnetic fields [2,3] to the manipulation of electronic flying qubits [4]. However, fully realizing this potential requires advanced tools capable of characterizing electronic excitations and detecting electronic entanglement in quantum coherent conductors.

While single electron tomography via two particle Hong-Ou-Mandel interferometry has been demonstrated [5], it remains limited by prohibitive measurement times and a lack of scalability for accessing two-electron coherence.

In this talk, we introduce a novel tomography technique based on photo-assisted filtering. This approach enables single electron coherence characterization via average dc-current measurements and two electron coherence access through low frequency current correlations [6]. We further discuss the potential of this technique for implementing entanglement witnesses adapted from quantum optics [7] to rigorously test electronic entanglement in ballistic quantum conductors.

## References

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## Figures

**Figure 1:** Upper part: Photo-assisted filtering as a pipeline between low amplitude ac drive and filtering by a quantum dot. Lower part: two electron coherence measurement in a generalized Franson geometry.

