Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Minimal-excitation states for electron quantum optics using levitons PREDEN ROULLEAU, THIBAUT JULLIEN, JULIE DUBOIS, FABIEN PORTIER, PATRICE ROCHE, CEA/Saclay, ANTONELLA CAVANNA, YONG JIN, LPN/CNRS, WERNER WEGSCHEIDER, ETH Zurich, D. CHRISTIAN GLATTLI, CEA/Saclay — The on-demand generation of pure quantum excitations is important for the operation of quantum systems, but it is particularly difficult for a system of fermions. This is because any perturbation affects all states below the Fermi energy, resulting in a complex superposition of particle and hole excitations. However, it was predicted nearly 20 years ago that a Lorentzian time-dependent potential with quantized flux generates a minimal excitation with only one particle and no hole. Here we report that such quasiparticles (hereafter termed levitons) can be generated on demand in a conductor by applying voltage pulses to a contact. Partitioning the excitations with an electronic beam splitter generates a current noise that we use to measure their number. Minimal-excitation states are observed for Lorentzian pulses, whereas for other pulse shapes there are significant contributions from holes. Further identification of levitons is provided in the energy domain with shot-noise spectroscopy, and in the time domain with electronic Hong–Ou–Mandel noise correlations.

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Date submitted: 14 Nov 2013 Electronic form version 1.4