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Electron occupancy of micro-structured helium-filled channels[1]
MAIKA TAKITA, F.R. BRADBURY, S.A. LYON, Department of Electrical Engineering, Princeton University — The spins of electrons floating on the surface of superfluid helium have been suggested to be promising qubits. High charge transfer efficiency of electrons in a narrow channel clocked with underlying gates, has been previously reported.[2] We have fabricated similar devices with an array of parallel channels and small gaps between the underlying gates. These channels are filled with superfluid helium by capillary action, onto which electrons are photoemitted. Electrons are initially trapped by a gate ("door"), so that they capacitively couple to a sense gate which is the input of a cold HEMT preamplifier. An oscillatory potential applied to a third gate moves electrons on and off the sense gate to allow lock-in detection. Electrons are allowed to escape the sensing region by slowly ramping down the door barrier. Features in the electron occupancy signal correlate with the oscillatory drive voltage and preamp gain, and show evidence of discrete occupancy as the channels depopulate.

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[2]G. Sabouret, F.R. Bradbury, S. Shankar, J.A. Bert, S.A. Lyon, Appl. Phys. Lett. **92**, 082104 (2008).

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