Architecture of nano-fabricated few electron devices
S. Ilani, A. Yacoby, D. Mahalu and Hadas Shtrikman (I)
Yang Ji, M. Heiblum, D. Sprinzak, D. Mahalu, and Hadas Shtrikman (II-III)
Weizmann Institute of Science, Israel

I

We fabricated a Single Electron Transistors (SET), having an aluminum metallic island size of 50nm x 500nm and tunnel junctions of 50nm x 30nm.

The process reported here is a novel Screened-Evaporation method for fabricating multi-layer structures of tunnel junctions – used in SET devices. This method allows forming two or more different metallic junctions, using a single lithographic step combined with controlled oxidation in between two metal evaporated contacts. The procedure proposed in this talk, has two important advantages over the common “Shadow-Evaporation” technique: first is the absence of false metallic shadows and second the avoidance of resist air bridges, thus enabling a higher resolution. Moreover, using different evaporation angles, we predict that multi-layer junction can also be produced.

II

Fabrication of Kondo-correlated systems on two-dimensional electron gas (2DEG).

In our work we produced a well defined 180X180nm quantum dot (QD), introduced into a double slit interferometer configuration. The fabrication of the interferometer requires an air bridge aligned to the first layer (with a precision down to ~80nm) in order to connect the middle island, which separates the two slits. The resulting device has a complicated structure, enclosing over 10 contacts over an area of 1µm².

III

Fabrication of a ring shaped electron interferometer

We present an electron-beam technique used in the fabrication of a semiconductor based electron interferometer. Such electron interferometer requires a metallic connection to a small Ohmic contact situated at the center of a conducting ring. The technique used incorporates: multiple e-beam writing steps aligned to alloyed metal alignment marks, micron size Ohmic contacts to a GaAs/AlGaAs 2DEG, an etching step performed by reactive ion etching aligned to the Ohmic contact layer and three “air bridges” of two different length scales (3µ and 0.2µ) fabricated in the same lithography step.