Mesoscopic Electronic Devices Fabricated Using Atomic Force Lithography

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Abstract

We present a range of mesoscopic electronic devices to demonstrate the versatility of the AFM (atomic force microscope) as a lithographic tool. We use the conducting tip of an AFM in a humid ambient to imprint on semiconducting surfaces oxide nano-structures whose di-electric properties permit us to manipulate and channel electrons to, or trap them at pre-determined sites. The devices we fabricated, some of which have been successfully tested, include one dimensional quantum channels, zero dimensional quantum dots, single and double quantum dots with detectors, and rings with dots that mimic Aharonov-Bohm devices. The robustness of our devices present AFM-based lithography as a fabrication technique of choice in tackling both the current and future challenges posed by the continuous miniaturization of electronic devices.

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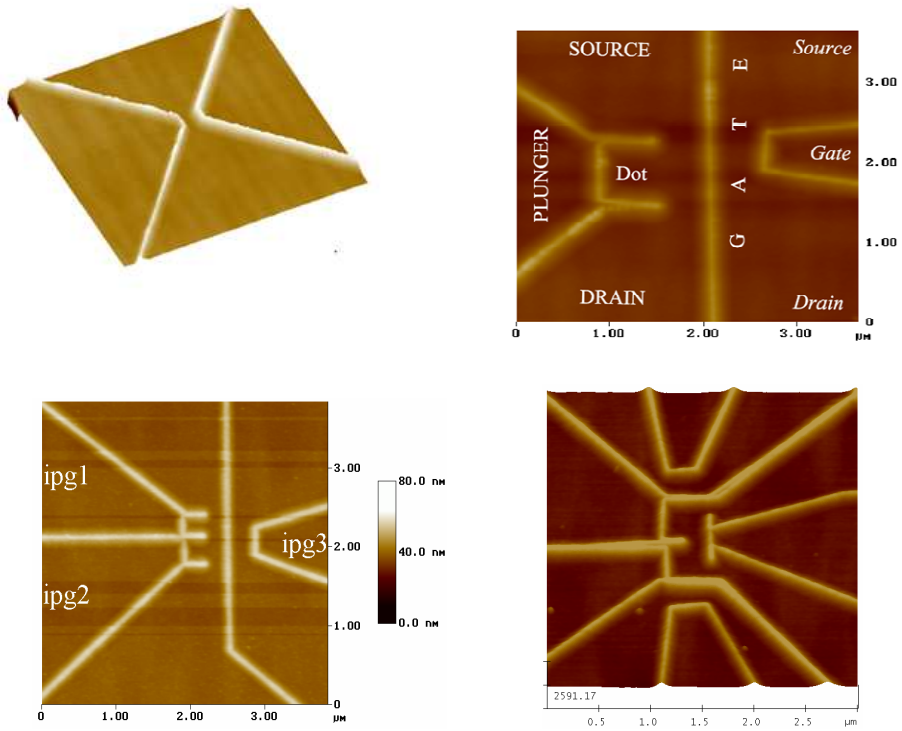

Figure 1: *AFM images showing examples of electronic devices fabricated using AFM-based lithography. The displayed devices are, clockwise, one dimensional quantum channel, single quantum dot with one dimensional detector, double quantum dots with two detectors, and double quantum dots with a detector. The one dimensional detectors are placed in close proximity to the dots to detect non-invasively the single electron tunnelling effects*