Oxide Nanoelectronics on Demand

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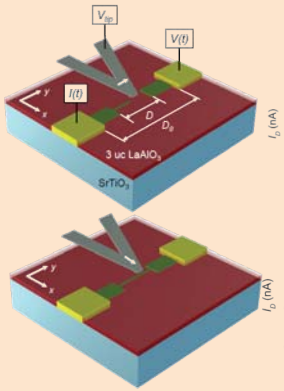
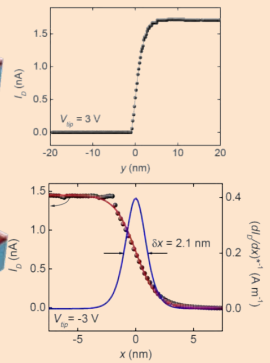
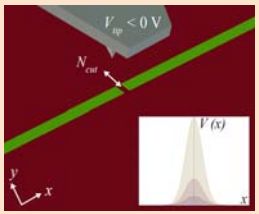




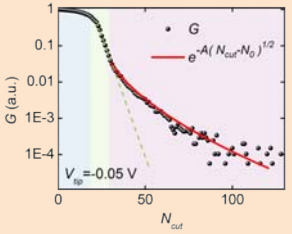
By scanning a positively biased conductive AFM tip in contact mode at $LaAlO_3$ top surface, nanoscale patterns of conductive regions can be written at the interface between $LaAlO_3$ and $SrTiO_3$ at room temperature.

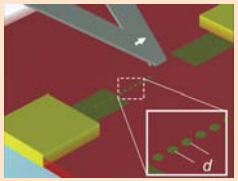
by scanning the same area with negatively biased AFM probe. Conductive nanowires as narrow as 2.1 nm and Isolated dots as small as 1 nm have been created.

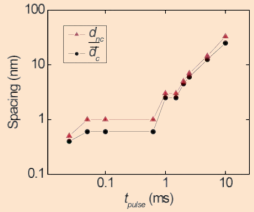


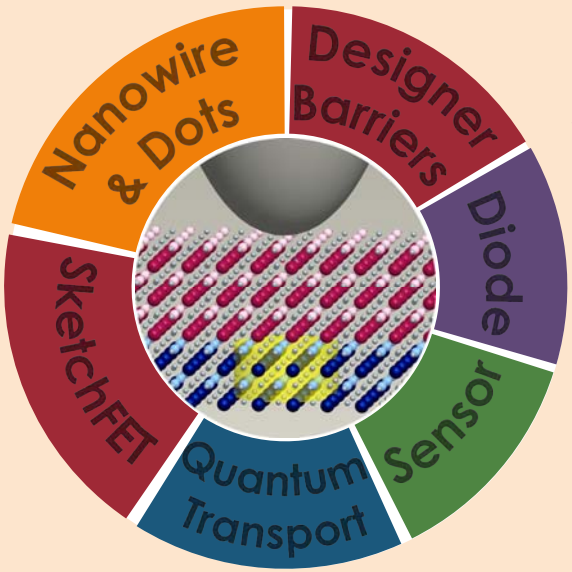
Direct conductive
→ Thermal hopping
→ Quantum tunneling

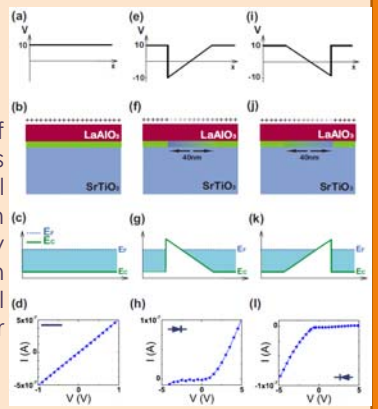
Potential barriers in the middle of a conducting channel can be created by applying a negative voltage to the AFM tip and scanning it across the channel.



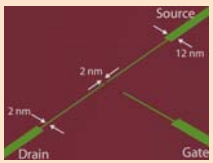




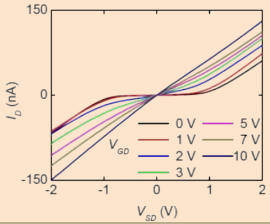


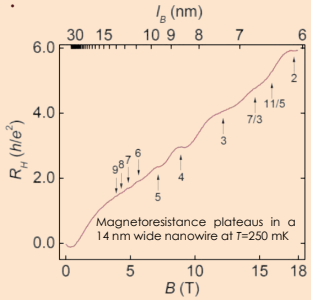


Rectification of transport, analogous with conventional Schottky diodes, can be achieved by creating an asymmetric potential barriers using triangular voltage profiles.



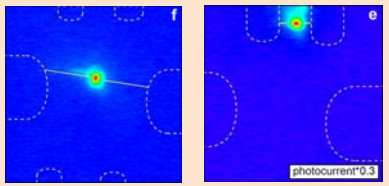
An in-plane sketch-defined field effect transistor (SketchFET) has been demonstrated at the LAO/STO interface. The transistor operates at greater than GHz frequencies and has an on:off ratio > 10^4.





Confinement of electrons in an one-dimensional nanowire can suppress backscat-tering and lead to the observation of quantum Hall states.

The conductance of the junction area in a SketchFET is sensitive to visible and infrared light. Sensitivity of the photocurrent is wavelength-dependent and can be tuned by gate bias. On-the-fly placement of photosensitive junctions can lead to novel applications in nanophotonic devices and optical sensors.



References

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3. D. F. Bogorin, C. Cen, and J. Levy, submitted (2010).
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5. D. F. Bogorin, C. Bark, H. Jang, C. Cen, C. Folkman, C. Eom, and J. Levy, *Appl. Phys. Lett* **97**, 013102 (2010).

This work is supported in part by NSF DMR-0704022