RESEARCH FUTURE ELECTRONICS

CNST Center for Nanoscale Science & Technology

An Advanced Ultra-Low Temperature Scanning Probe Microscope

PROJECT LEADER: Joseph Stroscio (NIST)

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GOAL

To develop an ultra-high vacuum, ultra-low temperature, high magnetic field scanning probe microscope in order to make measurements with unprecedented spatial and energy resolution on materials and nanostructures for future electronics.

KEY ACCOMPLISHMENTS

Made a series of ground-breaking measurements of the energy levels and structure of graphene, elucidating many of the unique properties of this material.

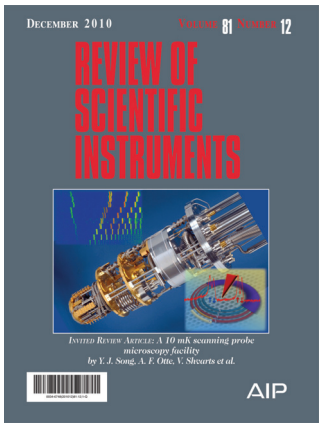
Characterized the metallic surface states of topological insulators and superconductors with atomic scale resolution.

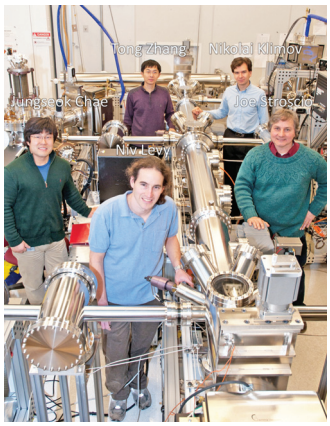
NEW MEASUREMENT CAPABILITIES

A scanning probe microscopy instrument that is capable of subpicometer stability and can operate in ultra-high vacuum at 10 mK, and in magnetic fields up to 15 T.

A facility that allows *in situ* tip and sample exchange, and can connect to and disconnect from a network of auxiliary ultra-high vacuum chambers, including growth chambers for metal and semiconductor samples, a field-ion microscope for tip characterization, and an independent quick-access low temperature (10 K) scanning probe microscope system.

Left: *Postdoctoral researcher Junghoon Ha performs maintanence on the ultra-high vacuum dilution refrigerator.*
Middle: *Cover image from the Review of Scientific Instruments issue featuring this instrument.*
Right: *The network of auxiliary ultra-high vacuum chambers used to prepare and characterize samples and probe tips.*





REFERENCE

A 10 mK scanning probe microscopy facility, Y. J. Song, A. F. Otte, V. Shvarts, Z. Zhao, Y. Kuk, S. R. Blankenship, A. Band, F. M. Hess, and J. A. Stroscio, *Review of Scientific Instruments* **81**, 121101 (2011).