

Electron Emission Testing Chamber

Materials Physics (J.R. Dennison)

Measurements of electron transport and emission properties of a wide variety of materials.

- **Electron Emission.** Measurements of electron- and photon-induced electron emission from conductors, insulators, nanoscale composites, and modified surfaces.
- **Extreme Insulators.** Studies of the effects of femtocoulomb charging on resistivity and electron emission of extreme insulators.
- **Spacecraft Charging.** Emphasis on applications to charging and discharging of spacecraft due to interaction with the space environment.



MISSE (Materials International Space Station Experiment) samples bound for 9-month deployment on the International Space Station.

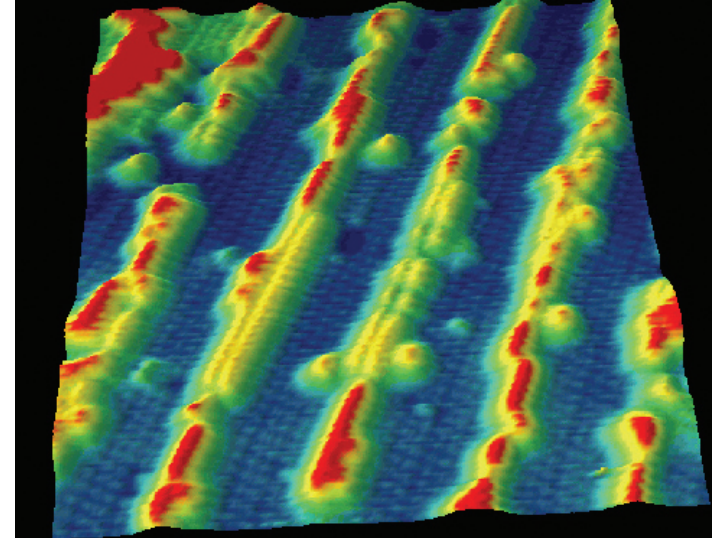
Did you know?

- It is only within the last two decades that the development of scanning probe microscopy has allowed us to realize a millennia-old dream of “seeing” atoms.
- The current nanoscale revolution is driven by our ability to see atoms and our increasing ability to manipulate them down to the single atom scale.
- Perhaps the greatest prize for nanoscience is to exploit the strange and remarkable manifestations of quantum mechanics exhibited by collections of atoms at the nanoscale.
- USU researchers in the Surface Physics group grow 1D, 2D and 3D devices on the atomic scale to tailor their quantum mechanical properties and investigate the transport of electrons, ions and photons on nanometer and femtosecond scales.
- Surface Physics Group undergraduate and graduate students engaged in active research have earned Goldwater Undergraduate and NASA Graduate Fellowships.
- The Surface Physics Group has received funding from NSF, DOE, DoD, DARPA, NASA, AFOSR, AFRL, PRF, Boeing, ATK Thiokol, Advanced Scientific, and Varian.

Interested?

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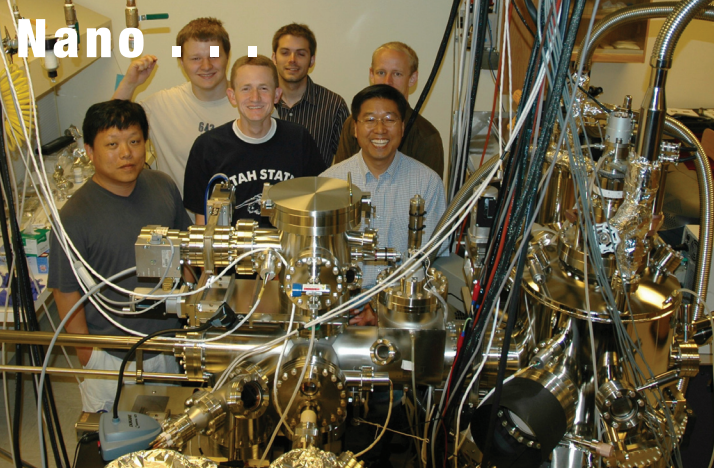
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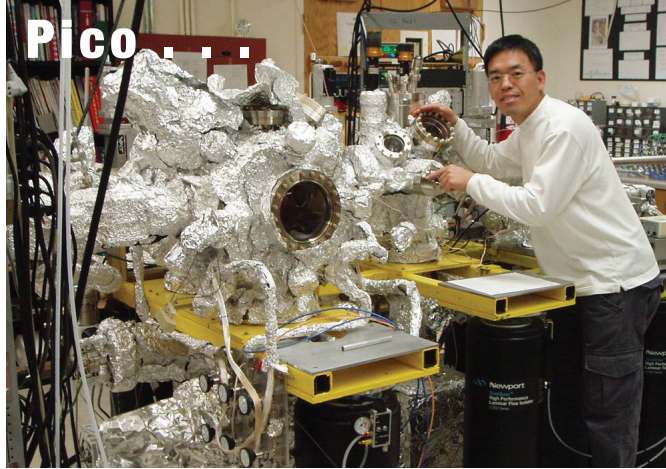
Surface Physics Group
Department of Physics



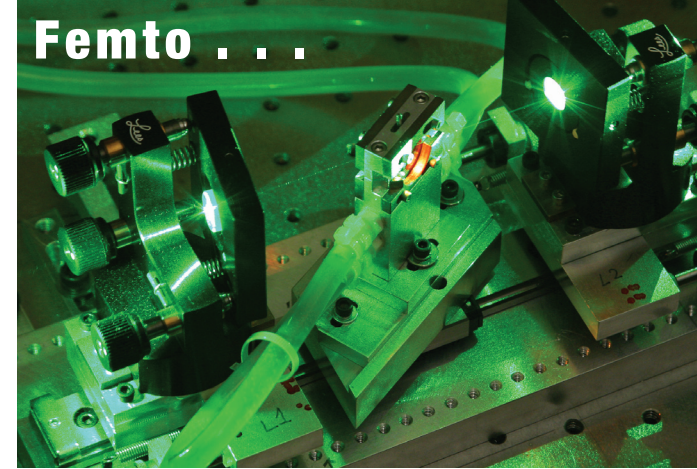
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Molecular Beam Epitaxy Nanofabrication



Nanoelectronics Growth and Test Chamber

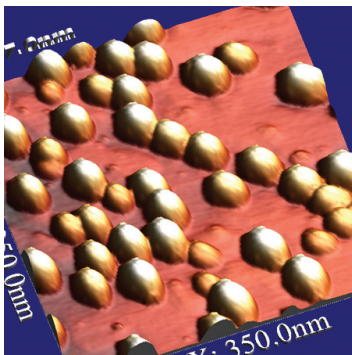


Ti: Sapphire Femtosecond Laser

Nanophotonics (Haeyeon Yang)

Development of nanoscale photonic devices based on embedded semiconductor quantum dots and wires.

- **Molecular Beam Epitaxy (MBE).** MBE growth of III-V semiconductors, one atomic layer at a time, with in-situ scanning-tunneling microscopy studies of the growth.
- **Materials/Surface Physics.** Control and measurement of novel nanostructure surface growth.
- **Nanophotonics.** New quantum nanostructures for photonics applications and next-generation nanostructure enhanced solar cells.

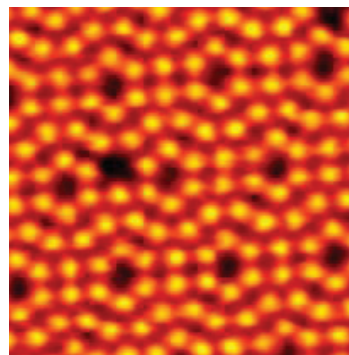


350 nm x 350 nm scanning tunneling microscope image of InGaAs quantum dots

Nanoelectronics (T.C. Shen)

Control of silicon surface physics and chemistry down to the single-atom scale to explore new electronic devices, integrated circuits, and computational algorithms.

- **Surface Physics.** Atom-scale surface reaction, imaging, and modification.
- **Nanoelectronics.** Fabrication of Si based nanoscale electronics in ultra-high vacuum.
- **Electron Transport.** Transport studies of novel structures down to 0.3 K with a 9 T superconducting magnet.

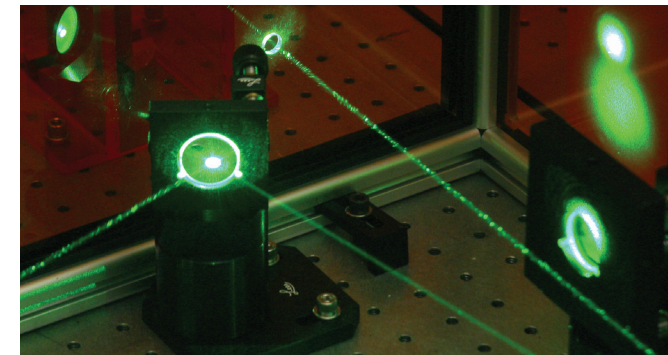


Scanning tunneling microscope image of Si(111) 7 x 7 surface reconstruction

Dynamics in Solids (D. Mark Riffe)

Studies of electronic and vibrational dynamics in solid-state materials.

- **Ultrafast Spectroscopy of Semiconductors.** Femtosecond pump-probe spectroscopy of fundamental excitations in semiconductors and metals.
- **Energy Gap Temperature Dependence.** Development of a spectral-density approach for analysis of the temperature dependence of semiconductor energy gaps.
- **Surface Vibrations.** Modeling of vibrations at surfaces using the embedded-atom method and related models.



Pump-laser beam for Ti:sapphire fs laser