Stanford University, Stanford, CA 94305

Center for Probing the Nanoscale - NSF NSEC Grant 0830228

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About the Center for Probing the Nanoscale

Stanford University and IBM Corporation, with funding from National Science Foundation, founded the Center for Probing the Nanoscale to achieve five principal goals, to:

- **breakthrough regions (D)** Tip penetration behavior
- **Goldhaber-Gordon**
- • Measure electronic properties of materials at 10 nm resolution
- • Nanoprobe tools under development
- Near-field Scanning Microwave Microscopy (NSMM): electric or magnetic coupling of a microwave signal from a tip to a sample
- Scanning Gate Microscopy (SGM): Electrostatic coupling of a quasi-DC tip voltage to sample

- **Partnerships with Formal and Informal Science Education**
- **Measure electronic properties of materials at 10 nm resolution**
- **• Tools under development:** Scanning SQUID Microscope, Scanning Hall Bar Microscope, Magnetic Force Microscope, Near-field Sagnac Microscope

- **Nanoscale Electrical Imaging**

Goldhaber-Gordon, Shen, Kelly, Pruitt

- **Melosh, Butte, Solgaard**
  - • Measure the forces, mechanical properties, and dynamics of biological membranes with critical resolutions of nanometers, microcords, and pN by developing and employing novel probes.
  - • Combine ultrafast cantilevers with bio-functionalized stealth probes to insert into the membrane

- **Bio-Probes**
  - **Right:** Nanoantennas and near-field magnetic resonance imaging
  - **Nanoantennas**
  - **Sagnac**
  - **Individual Nanomagnet Characterization**

Moler, Kirtley, Kaputnik, Moerner

- **Moler, Kirtley, Kaputnik, Moerner**
  - • Develop and demonstrate techniques with the magnetic sensitivity and spatial resolution to characterize individual nanomagnets
  - • Tools under development:
    - Scanning SQUID Microscope, Scanning Hall Bar Microscope, Magnetic Force Microscope, Near-field Sagnac Microscope

- **Nanoscale Magnetic Resonance Imaging**

Rugar, Pruitt

- **Rugar, Pruitt**
  - • Advancing development of Magnetic Force Resonance Microscopy (MFRM) toward a local spectroscopic probe of two-dimensional electron systems,
  - • Non-destructive and elementally selective 3D imaging technique
  - • Goal: extending spatial resolution to below 1 nm

- **Educational and Industrial Outreach**

Teacher Programs

- **Summer Institute for Middle School Teachers**
  - • Inspire middle school students in science by educating and training their teachers
- • Online Teacher Resources
  - http://nanoteachers.stanford.edu
- • Activities linked to Science Standards
- • Classroom Materials
- • Teacher Preparation Materials
- • Lending Library
- • Development of low-cost classroom activities with Bay Area distribution through Resource Area for Teachers (RAFT)
- • Industry Field-trips for students
- • Career Workshops and Seminars

Industrial Outreach

- **Annual Nanoprobes Workshop**
  - • Bring together academic and industrial scientists to exchange knowledge and ideas
  - • Broaden the horizons of participants
  - • Initiate research projects with industry
  - • Provide venue for interaction between industry and graduating students
  - • ~200 participants
  - • 13 companies
- • Industry Field Trips
- • Industrial Affiliates Programs
  - • Sponsored research programs
  - • Participation in Center activities

Selected 2010 Publications