Atomic Force Microscopy
Lunch & Learn Seminar

Duke University, Durham, NC

Duke University SMIF in collaboration with **Bruker Nano Surfaces** is presenting a lunch and learn event on July 19th. The session will feature the nano-surface imaging and characterization capabilities of SMIF's atomic force microscopes from Bruker.

The Shared Materials Instrumentation Facility (SMIF) is the Pratt School of Engineering's core facility that enables materials, devices, and integrated systems research at Duke University in a variety of fields that include nanotechnology, biomaterials and biomedical engineering, information sciences, optoelectronics, sensor technology, and renewable energy.

Wednesday, July 19, 2017

Teer 203 – 9:00am to 11:00am

Combined AFM and Vertical Light-Sheet Sideways Microscopy for Living Cell Studies
Presenter: Dr. Mike Falvo

New Modes for New Research – From Nanomechanics to Conductivity in Liquid
Presenter: Dr. Thomas Mueller

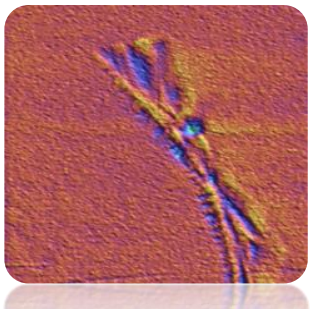
Fitzpatrick 1557 – 12:00pm to 3:00pm

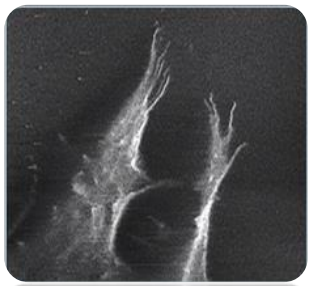
Dimension Icon Demos

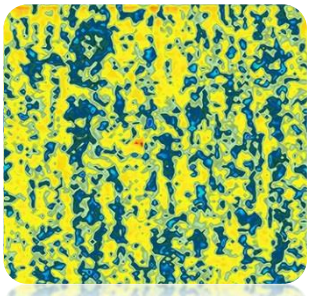
Coffee, tea and donuts will be provided in AM;
Lunch will be provided from 11:00am to 12:00pm for attendees who register.

REGISTER ONLINE

www.bruker.com/BNS-NA-Workshops







Atomic Force Microscopy
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Technical Talk Abstracts:

New Modes for New Research

New AFM modes from Nanomechanics to Conductivity in liquid
Dr. Thomas Meuller, Director of Applications Development

The Atomic Force Microscope has evolved from a laboratory sensation in the late 80's to a widely used tool in materials and life science research today. Numerous innovations have driven this evolution, in particular the introduction of new imaging modalities and the parallel development of AFM probe technology, leading to a vast expansion of samples accessible and information revealed by AFM.

In this seminar we will focus on the very advances in Bruker's AFM technology, including both, novel modes and probes, and the new information they make available enabling new research today. In life sciences, we will show how the evolution of modes from contact to Tapping and PeakForce Tapping has enabled a range of studies from sub molecular structure, where Pyne et al have studied such subtle phenomena as the variability of the DNA double helix structure, to imaging mammalian cells, with first and only AFM images of microvilli on live cells, and extending to cell biomechanical studies that unravel Nanomechanical signatures of cell state, disease progress, and the role of cell membrane receptors. In materials research, we will cover the latest advances in quantitative Nanomechanics of heterogeneous polymer samples and composites at high spatial resolution and at interfaces with PeakForce QNM, FastForce Volume, and contact resonance. Finally, we will cover our most recent extensions of AFM electrical measurements. Having pioneered conductivity measurements on soft and fragile samples with PeakForce TUNA, we have introduced analogous subsurface and impedance measurements with PeakForce sMiM, as well as conductivity in liquid and nanoscale electrochemical measurements with PeakForce SECM.

Combined AFM and Vertical Light-Sheet Sideways Microscopy for Living Cell Studies
Mike Falvo, Kellie Beicker, Evan Nelsen, Tim O'Brien, Richard Superfine

The ability of living cells to withstand external mechanical forces and convert mechanical stimuli into biological responses is essential to the physical integrity and biological functions of the cell. Abnormal cellular response to mechanical stimuli has been correlated with disease states, including cancer. Structural information related to rearrangement of the cytoskeletal structure, induced strains, and biochemical distributions are metrics for understanding cell response. However, structural information during applied stress is limited by our ability to image the cells under load, especially in the direction of applied force. In order to study the mechanics of single cells and subcellular components under load, we developed a unique imaging system that combines an atomic force microscope (AFM) with a new imaging technique called vertical light-sheet sideways microscopy (VLSSM). VLSSM combines pathway rotated imaging to facilitate the viewing of downward cell deformation by the applied force of the AFM tip and vertical light-sheet illumination to improve the signal-to-noise ratio achieved by illumination of a thin vertical slice of the cell. The combined AFM-VLSSM system enables simultaneous millisecond imaging and pico-Newton resolution force measurements. We use this new technique to observe force rupture events correlated with detachment of single membrane tethers from a functionalized AFM tip. Force rupture events are correlated with motion of the membrane and intracellular motion, including nuclear deformation attributed to nano-Newton forces applied to attachments at the cell membrane.