



Dr. Roger Proksch
President, Asylum Research
Santa Barbara, California

Multifrequency Atomic Force Microscopy

An ongoing “holy grail” quest of AFM is quantitative functional and compositional mapping of material properties. Qualitatively, the methods described in this talk and in the literature have been quite successful in mapping relative differences between various regions of a multi-component sample. Phase imaging was one of the first AFM techniques that reliably showed contrast apparently related to materials properties. There were numerous attempts at quantifying this contrast in terms of those material properties – Piezo response coefficients, Young’s modulus, Hamaker constants and so on. One of the most significant breakthroughs was linking phase contrast to energy dissipation between the tip and the sample. Despite the contrast, phase images do not necessarily carry unambiguous quantitative information about the sample composition or mechanical properties.

Recently, there has been a significant effort using multifrequency measurements that include passive techniques such as harmonic imaging where nonlinearities can be used to learn about nonlinearities in the tip-sample interactions and reconstruct interaction forces or potentials. Active techniques where the cantilever is driven at more than one frequency are also being developed. In this case, one exciting realization is that model parameters, heretofore underdetermined by single frequency measurements can now be unambiguously quantified.

True quantitative mapping is a much more serious challenges that can also be viewed as opportunities for future work. Experimental and theoretical barriers to achieve true quantitative mapping will be outlined, as will numerical and experimental approaches to overcome them.

Finally, interspersed in this talk will be a discussion of the game-rules for physicists at a company – especially a small company. They are significantly different than those our academic colleagues play by. I will describe some of the trials and tribulations (and some fun things too!) a physicist who was trained at a traditional US university encounters after deciding to start and operate a scientific instrumentation company.

Wednesday, December 7, 2011
3:30 pm - Room 151, Jorgensen Hall
Refreshment at 3:15 pm

Host:
Dr. Alexei Gruverman
Department of
Physics & Astronomy

Please Post