

Abstract Submitted  
for the MAR13 Meeting of  
The American Physical Society

**Intermodulation Spectroscopy applied to AFM** DAVID HAVILAND, DANIEL PLATZ, DANIEL FORCHHEIMER, The Royal Institute of Technology (KTH), ERIK THOLÉN, Intermodulation Products AB — Measurement of surface forces at the single atom level is usually achieved by exploiting the enhanced sensitivity of a high quality factor resonator in ultrahigh vacuum, with small measurement bandwidth and therefore slow measurement speed. Frequency modulation AFM allows one to overcome this limitation, at the price of one extra feedback loop and very limited quantitative information about the interaction forces between the tip and the surface while imaging. We have introduced a multi-frequency method called Intermodulation AFM (ImAFM), which can be seen as containing features of both the amplitude modulation and frequency modulation AFM methods. In this talk we describe ImAFM in its most general form, where the nonlinear tip surface interaction is seen as transferring an input drive frequency comb, to an output frequency comb. These frequency combs can represent either amplitude modulated or frequency modulated signals, or both. It is demonstrated how the method optimally exploits the frequency band near resonance to extract as much information as is possible for a given measurement bandwidth. With this frequency-domain information one can reconstruct both conservative and dissipative tip-surface interactions with unprecedented accuracy and speed.

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Date submitted: 09 Nov 2012

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