Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Jumping, snapping and popping at nanometer scale DAVID HAVILAND, Royal Institute of Technology — The 'jump-to-contact' instability is well known in Atomic Force Microscopy. When a tip attached to a soft cantilever approaches a surface, the large attractive force gradient disrupts the quasi-static force balance and the tip snaps in to contact with the surface. Less appreciated is the converse instability, where a soft liquid-like polymer surface jumps to meet the tip. This nano-scale pop is inaudible, but it does leave a distinctive signature if one carefully monitors the cantilever's steady state dynamics when driven with multiple tones. The nonlinear tip-surface interaction causes intermodulation, or frequency mixing of the drive tones. When many intermodulation products are measured close to the cantilever resonance the spectrum can be transformed to reveal the in-phase and quadrature forces acting on the tip, as a function of oscillation amplitude. We present experimental measurements and theoretical modelling that reveal this surface-jump-to-tip instability.

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Date submitted: 14 Nov 2014 Electronic form version 1.4