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**Tip-Sample Gap control for truly noncontact operation on an AFM** YEHIAM PRIOR, ALEXANDER MILNER, Department of Chemical Physics, Weizmann Institute of Science, Rehovot, Israel 76100 — A new mode of operation is introduced to standard atomic force microscopes, working under ambient conditions, for noncontact operation at a small predetermined Tip Sample Gap (TSG) of a few nanometers. A phase-locked loop, based on tiny oscillations ( $<1$  nm) of the cantilever at a frequency far from the cantilever mechanical resonances, is used to maintain the gap between the tip and the sample at a range of 1 - 4 nanometers. The noncontact hovering of the tip is maintained for long times without the tip ever touching the surface. The TSG is calibrated by the far field scattering of evanescent fields over transparent samples. A typical measurement run provides, in addition to the standard topography, information about the amplitude and phase of the new oscillations, as well as information about the shear forces based on lateral oscillation of the sample relative to the tip. In a geometry characteristic for Apertureless Scanning Near Field Optical Microscope, the tip is illuminated by a focused beam of a femtosecond laser (800 nm, 20 fsec, 100 mw ) for nano-patterning of the area under the tip.

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