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Cantilever mean deflection: average tip-sample force in tapping mode spectroscopy F. MICHAEL SERRY — In tapping mode AFM spectroscopy, tip-sample interaction is nearly always studied in cantilever amplitude and phase. Theory shows that the *mean* deflection is another quantity that carries a wealth of information about the interaction (1). However, mean deflection remains largely unexplored in experiments. One historic reason is tapping mode was invented to avoid relying on static (mean) deflection of cantilever in contact mode AFM. Mean deflection is easier to measure with softer cantilevers, and becomes more important with smaller amplitudes. We present mean deflection data which often contain features with no readily decipherable counterparts in amplitude or phase; validate some theoretical results; and possibly contradict others. The data (vs. mean tip-sample separation) provide a direct, intuitive, experimental proof that phase follows the polarity of average tip-sample force (2). However, the slope of this data does not always follow that of the phase. Average force often plateaus as mean separation reduces and even approaches zero, which may help explain why similarly high-quality images are frequently possible across a range of amplitude setpoint values. (1) A. San Paulo, R. Garcia, Phys Rev B (64), p193411, 2001. (2) R. Garcia, A. San Paulo, Phys Rev B (60), p4961, 1999.

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