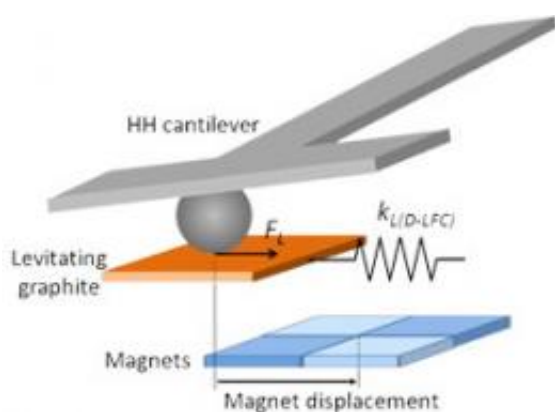


# Researchers validate simplified lateral force calibration technique for atomic force microscopy

March 29 2012, By Rachel Cannara



In the diamagnetic lateral force calibration method, an AFM cantilever (shown here is a NIST HammerHead cantilever) presses against the surface of a piece of graphite that levitates in a magnetic field. When the magnetic field is moved horizontally in the AFM, friction between the AFM tip and graphite surface causes the cantilever to twist. This twist leads to a change in the lateral signal in the AFM that is used to calibrate friction directly, based on the spring constant of the graphite in the magnetic field.

(PhysOrg.com) -- Researchers from the NIST Center for Nanoscale Science and Technology and the NIST Material Measurement Laboratory have demonstrated that a simpler technique for calibrating lateral sensitivity in an atomic force microscope (AFM) agrees with an earlier method developed at NIST to within 5 %.

The equivalence of these two independent methods represents an important step towards traceable accuracy in lateral force microscopy and will allow scientists to better understand the atomic-scale origins of [friction](#) across a wide range of materials.

The [NIST](#) “HammerHead” (HH) [method](#) relies on precise positioning of the arms of a specially-fabricated, tee-shaped cantilever over well-defined alignment marks in a surface; a torque is applied at different locations on the cantilever arm by pressing it against a small sphere attached to the edge of the surface.

The ratio of the change in the normal (vertical) signal to the lateral signal can be used to calibrate sensitivity and extract friction forces corresponding to the lateral signals measured during an experiment.

The new “Diamagnetic Lateral Force Calibrator” (D-LFC) method, developed at Brown University, requires fewer independent measurements. The AFM cantilever presses against the surface of a piece of graphite that levitates in a magnetic field. When the magnetic field is moved horizontally in the AFM, the levitating graphite behaves like a mass on a very weak spring.

A lateral force is applied by the graphite to the tip of the AFM cantilever, causing the [cantilever](#) to twist. This twist leads to a change in the lateral signal in the AFM that can be used to calibrate friction directly, without the need for an independent measurement of the normal signal.

While the D-LFC method is preferable for most circumstances, because it uses fewer parameters and therefore has greater precision, the HH method can be advantageous if contact between the probe tip and the calibration surface must be avoided.

The researchers believe that the overall [accuracy](#) and comparability of these two methods establishes the importance of the D-LFC method as a valuable tool for unifying quantitative measurements of friction at the nanoscale, and establishes a potential path towards the development of lateral force standards.

**More information:** Quantitative comparison of two independent lateral force calibration techniques for the atomic force microscope, S. S. Barkley, et al., *Review of Scientific Instruments* 83, 023707 (2012).  
[rsi.aip.org/resource/1/rsinak/v83/i2/p023707\\_s1](http://rsi.aip.org/resource/1/rsinak/v83/i2/p023707_s1)

Provided by National Institute of Standards and Technology

Citation: Researchers validate simplified lateral force calibration technique for atomic force microscopy (2012, March 29) retrieved 20 March 2024 from  
<https://phys.org/news/2012-03-validate-lateral-calibration-technique-atomic.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.
---