The effect of the Phantom Force on Kelvin Probe Microscopy

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We have recently demonstrated a dominating effect that the tunnel current can have upon AFM imaging: While it is common practice in NC-AFM to apply a bias voltage between the tip and sample in order to decrease the attractive long-range electrostatic force, when the sample and tip are not insulating, this can induce a tunnel current. The voltage drop of this current can be significant due to the large areal current density, affecting the electrostatic force and inducing a "phantom" atomic contrast in AFM images [1].

There are still many open questions that remain about this phenomenon, including its influence on local Kelvin probe measurements. I will present force-bias spectra on silicon surfaces, discussing the breakdown of the Kelvin parabola and the influence of the phantom force upon determining local contact potential differences.

References

[1] A.J. Weymouth, T. Wutscher, J. Welker, T. Hoffmann and F. J. Giessibl, Phys. Rev. Lett., 106, 226801, (2011)