Abstract Submitted
for the MAR11 Meeting of
The American Physical Society

Vacuum Phonon Tunneling in Variable Temperature STM[1] IGOR ALTFEDER, ANDREY VOEVODIN, AJIT ROY, Air Force Research Laboratory — We demonstrate that the temperature of the terminating atom of STM tip can be directly measured by inelastic electron tunneling spectroscopy. A previously unknown mechanism of interfacial thermal transport, field-induced phonon tunneling, has been revealed by ultrahigh vacuum scanning tunneling microscopy. Using thermally broadened Fermi-Dirac distribution in the STM tip as in-situ atomic scale thermometer we found that thermal vibrations of the last tip atom are effectively transmitted to sample surface despite few angstroms wide vacuum gap. We show that phonon tunneling is driven by interfacial electric fields and thermally vibrating image charges, "thermal mirages". By comparing experimental data and theory, we show that the thermal energy transmitted through atomically narrow vacuum gap due to thermal vibration of image charges exceeds, by ten orders of magnitude, the Planck's thermal radiation energy. Reference: I. Altfeder, A. A. Voevodin, A. K. Roy, PRL 105, 166101 (2010)

[1]Research is funded by AFOSR

Igor Altfeder
Air Force Research Laboratory

Date submitted: 19 Nov 2010 Electronic form version 1.4