Abstract Submitted
for the MAR05 Meeting of
The American Physical Society

Ultrafast evolution of the surface plasmon resonance in vanadium dioxide nanoparticles[1] MATTEO RINI, ANDREA CAVALLERI, ROBERT SCHOENLEIN, Lawrence Berkeley National Laboratory, RENE LOPEZ, LEONARD FELDMAN, RICHARD HAGLUND, Vanderbilt University, LYNN BOATNER, TONY HAYNES, Oak Ridge National Laboratory — Vanadium dioxide nanoparticles undergo a metal-insulator transition (MIT) at approximately 340K that has been shown to depend on nanoparticle size and shape. Here we report on the temporal evolution of the metallic phase in VO_2 nanoparticles following ultrafast laser excitation. The signature of the MIT is the appearance of the surface plasmon resonance (SPR) in the near-infrared. Femtosecond measurements of the temporal evolution of the SPR in VO_2 nanoparticles show that it is fully formed no later than 200 fs following excitation by a 100 fs laser pulse that initiates a band-to-band excitation. The wavelength dependence of the SPR generally follows Mie theory and agrees with the SPR spectrum observed when the MIT is initiated by slow heating. The rapidity of the transition, as well as its dependence on nanoparticle size, suggests that electronic mechanisms are responsible at least for the initiation of the MIT. A possible coupled electronic-vibronic mechanism for the MIT will be disussed in this context.

[1]Research supported by the U. S. Department of Energy.

Richard Haglund
Vanderbilt University

Date submitted: 07 Dec 2004 Electronic form version 1.4