Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

Voltage mediated metal to insulator transition in VO_2 and V_2O_3 nanodevices[1] ILYA VALMIANSKI, Physics Department, UC San Diego, J. GABRIEL RAMIREZ, Physics Department, Universidad de los Andes, SIMING WANG, Livermore Berkeley National Laboratory, STEFAN GUENON, Physics Department, University of Tuebingen, IVAN K. SCHULLER, Physics Department, UC San Diego — We investigate the mechanism of the voltage mediated MIT in a series of vanadium oxides (VO_2 and V_2O_3) nano-scopic devices. All films presented ˜4 orders of magnitude resistance change at the MIT. The devices consist of in-plane gold electrodes with 200 nm wide tip on top of lithographically defined vanadium oxide films. The gap size between electrodes was fixed at 140 nm. Unlike micron-scale devices, the current-voltage characteristics in nano-scale V_2O_3 cannot be accounted solely by an inhomogeneous joule-heating model, suggesting additional mechanisms may be playing a role in the switching behavior. However, in the case of nano-scopic VO_2 devices, it may be possible to explain the results with only inhomogeneous heating. We perform detailed electrical and thermal Finite Element Method (FEM) calculations on both the VO_2 and V_2O_3 devices. We couple the FEM analysis with a variety of theoretical models, which can shed light on the nanoscopic nature of the MIT in VO_2 and V_2O_3.

[1]Work supported by AFOSR.

Ilya Valmianski
Physics Department, UC San Diego

Date submitted: 05 Nov 2015 Electronic form version 1.4