Abstract Submitted
for the MAR11 Meeting of
The American Physical Society

Fast pulsed measurements of the electric-field-driven metal-insulator transition in magnetite[1] J. SPENCER MORRIS, Rice University, Houston, TX, R.G. SUMESH SOFIN, IGOR V. SHVETS, Trinity College, Dublin, IE, DOUGLAS NATELSON, Rice University, Houston, TX — Magnetite, Fe3O4, is an example of a strongly correlated material in which strong electron-electron interactions lead to unusual magneto-electronic properties. In particular, it undergoes a first-order phase transition on cooling through TV$\sim$122K in bulk, in which a structural transition is accompanied by a significant drop in electrical conductivity. Recent electronic transport measurements have shown an electric-field driven breakdown of the insulating state in large aspect-ratio nanogaps fabricated on magnetite thin-films. The mechanism of this breakdown is of great interest in understanding the Verwey transition, and probing the intrinsic speed of the breakdown may further constrain possible mechanisms. We investigate the kinetics of this nonequilibrium transition by employing a high-speed pulse generator to apply voltages approaching the nanosecond time scale that exceed the critical switching value, and measuring the transmitted pulse via a high-speed oscilloscope. A significant change in transmission is observed for pulses that exceed the critical amplitude necessary to initiate the transition. Our initial results include an evaluation of the material response as a function of temperature and amplitude of the applied voltage.

[1]This work is supported by DOE award DE-FG02-06ER46337.

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Date submitted: 03 Jan 2011 Electronic form version 1.4