Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

Doping induced metallization of a narrow gap insulator $FeGa_3$
MONIKA GAMZA, Brookhaven National Laboratory, AKSHAT PURI, Stony Brook University, JAN TOMCZAK, Rutgers University, JIM QUINN, Stony Brook University, MEIGAN ARONSON, Stony Brook University and Brookhaven National Laboratory — Narrow gap semiconductors attract great interest owing to an unusual metallization process which remains poorly understood despite decades of extensive research [1]. Here, we report on the effects of hole doping on properties of a nonmagnetic semiconductor $FeGa_3$ with a band gap of 0.4 eV [2]. By means of electrical resistivity, magnetization and specific heat measurements performed on single crystals grown from gallium flux we have found that a substitution of Mn for Fe in $Fe_{1-x}Mn_xGa3$ ($0.005< x < 0.03$) yields an insulating state at high temperatures with residual magnetic moments. With lowering temperature, resistivity deviates from an activation-type behavior and nearly saturates at $T<100$ K. Finally, it drops by as much as two orders of magnitude at temperature of 6 K, indicating a metal-insulator transition. Magnetization measurements did not show magnetic order associated with the transition. When an external magnetic field is applied, the metal-insulator transition moves to lower temperatures and eventually the resistivity returns to the insulating-type behavior in fields higher then of 5 Tesla.

[1] M. Imada et al, Rev. Mod. Phys., 70, 1039 (1998)
[2] M. Arita et al., Phys. Rev. B 83, 245116 (2011); Y. Hadano et al., J. Phys. Soc. Jpn. 78, 013702 (2009)

Monika Gamza
Brookhaven National Laboratory

Date submitted: 20 Nov 2012 Electronic form version 1.4