Abstract Submitted
for the MAR07 Meeting of
The American Physical Society

Evidence of impurity band conduction in GaMnAs LEONID ROKHINSON, YULI LYANDA-GELLER, Purdue University, Z. GE, S. SHEN, X. LIU, M. DOBROWOLSKA, JACEK K. FURDYNA, University of Notre-Dame —
We investigate low-temperature conduction in GaMnAs, and demonstrate that the observed properties are inconsistent with the valence band transport, but consistent with the metallic transport of holes within the impurity band. We observe a peak in magnetoresistance at very small magnetic fields $B < 20$ mT, which is independent of orientation of B with respect to the ferromagnetic easy axis and to the direction of the electric current. The peak appears below 3.4 K and increases at lower temperatures. We attribute this effect to the anomalous negative magnetoresistance of the Aharonov-Bohm (AB) origin. The shape and magnitude of the peak is consistent with weak localization (WL) in a three dimensional (3D) conductor with vanishing spin-orbit interaction. Holes in the valence band, on the contrary, experience strong spin-orbit interaction, which would suppress weak localization in a ferromagnet. In addition to WL we observe a field-independent increase of resistance at $T < 5$ K, a signature of Altshuler-Aronov (AA) electron-electron interaction effect. Temperature dependent AA contribution to resistivity is almost an order of magnitude bigger than the magnitude of magnetoresistance peak, as it should be in conventional 3D disordered conductors.

Leonid Rokhinson
Purdue University

Date submitted: 20 Nov 2006 Electronic form version 1.4