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The intra-gap electromagnetic response of gated GaMnAs in an electric double-layer field effect BRIAN CHAPLER, T.W. ELSON, University of California San Diego, S. MACK, D.D. AWSCHALOM, University of California Santa Barbara, E. NAMDAS, University of Queensland, J. YUEN, A.J. HEEGER, University of California Santa Barbara, L. JU, F. WANG, University of California Berkeley, D.N. BASOV, University of California San Diego — We have fabricated field effect transistors (FETs) utilizing an electrolyte oxide gate insulator for monitoring electrostatic doping in GaMnAs via infrared (IR) spectroscopy. Previous studies of gated GaMnAs have been confined primarily to transport measurements. IR experiments are able probe the electric field induced changes to the optical conductivity spectrum, providing direct insight into electronic structure of GaMnAs. The IR spectra show an enhancement of the Drude response and mid-IR resonance of GaMnAs upon hole accumulation, with symmetric decrease in these features in the depletion mode. A sum rule analysis of the IR spectra, combined with charge accumulation/depletion information from transport measurements for the same gated structures, enables accurate evaluation of the effective masses of mobile holes without any underlying assumptions about the level of compensation and/or disorder in the films. The low bound for the effective mass is several m_e, where m_e is the free electron mass. We therefore conclude that electronic states in the vicinity of the Fermi energy retain significant impurity band character.

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