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Infrared probe of charge density modification in GaMnAs films BRIAN CHAPLER, University of California, San Diego, R.C. MYERS, Ohio State University, S. MACK, E. NAMDAS, J.D. YUEN, A.J. HEEGER, University of California, Santa Barbara, N. SAMARTH, Pennsylvania State University, M.C. MAR-TIN, Lawrence Berkeley National Laboratory, K.S. BURCH, University of Toronto, D.N. BASOV, University of California, San Diego, D.D. AWSCHALOM, University of California, Santa Barbara — We have explored the phase diagram of GaMnAs by modifying charge density and quantifying its effect on the electronic structure and dynamics via infrared spectroscopic measurements. Optical conductivity spectra from THz to the band gap of the GaAs host are found to have a similar lineshape consisting of finite far-infrared conductivity and a mid-infrared peak in the vicinity of the Mn acceptor state. The similarity of all spectra suggests that the electronic structure does not vary dramatically across either the insulator-to-metal or ferromagnetic transition. However, in all cases studied, the spectra show a persistent red-shift of the mid-infrared peak with an increase in charge density. In addition, temperature-dependent measurements reveal that ferromagnetic samples exhibit an enhanced spectral weight below T_C . This enhancement can be attributed to a reduction of the carrier mass, a feature which is not observed in paramagnetic GaMnAs.

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