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On magnetism and the insulator-to-metal transition in p-doped GaAs BRIAN CHAPLER, University of California San Diego, R.C. MYERS, Ohio State University, S. MACK, University of California Santa Barbara, A. FRENZEL, B.C. PURSLEY, University of California San Diego, K.S. BURCH, University of Toronto, E.J. SINGLEY, California State University East Bay, A.M. DATTELBAUM, Los Alamos National Laboratory, N. SAMARTH, Pennsylvania State University, D.D. AWSCHALOM, University of California Santa Barbara, D.N. BASOV, University of California San Diego — Although $Ga_{1-x}Mn_xAs$ is often described as the prototypical ferromagnetic semiconductor, many aspects of the electronic structure and nature of mediating carriers remain open. A central question in this regard is whether the insulator-to-metal transition (IMT) in p-doped GaAs is significantly modified when dopants are magnetic. We address this through an infrared spectroscopic study of GaAs doped with either non-magnetic Be or magnetic Mn acceptors. Through our comparison, we are able to isolate effects of magnetic dopants in GaAs from those associated with disorder and proximity to the IMT. Here we show Mn-doped samples exhibit an unusual electronic transport regime, combining elements of both metallic and insulating behavior, at doping concentrations far beyond the onset of the IMT. Be-doped films however, reveal genuine metallicity just above the IMT boundary. These results underscore the pivotal role of magnetism in transport and optical phenomena of $Ga_{1-x}Mn_xAs$.

Brian Chapler
University of California San Diego

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