MAR08-2007-000968

Abstract for an Invited Paper
for the MAR08 Meeting of
the American Physical Society

Optical Properties of III-Mn-V Ferromagnetic Semiconductors

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We discuss the important role optical studies have played in our understanding of the electronic structure of III-Mn-V ferromagnetic semiconductors. These extensive studies have established the electronic structure is strongly affected by the strength of the exchange between the Mn local moments and the holes they introduce. Particular focus is given to $Ga_{1-x}Mn_xAs$, where spectroscopic studies suggest the metallic state is unconventional. Finally, we will detail our recent experiments into the ultrafast manipulation of magnetism on the nanoscale. This work is in collaboration with D.B. Shrekenhamer, E.J. Singley, D.N. Basov (University of California, San Diego) J. Stephens, S. Mack, R.K. Kawakami, D.D. Awschalom(University of California, Santa Barbara), B.L. Sheu, N. Samarth (Pennsylvania State University), F. Chen, A. Azad, J. O'Hara, A.M. Dattelbaum, G. Montano, S. Crooker, and A.J. Taylor (Los Alamos National Laboratory).