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Magneto-optical studies of magnetic and non-magnetic narrow-gap semiconductors

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In light of the growing interest in spin-related phenomena and devices, there is now renewed interest in the science and engineering of narrow gap semiconductors. Narrow gap semiconductors (NGS) offer many unique features such as small effective masses, high intrinsic mobilities, large effective g- factors, and large spin-orbit coupling effects. This talk will discuss our recent magneto-optical studies on InSb quantum wells (QWs) and InMnAs ferromagnetic heterostructures. In InSb QWs, we observe spin-resolved cyclotron resonance (CR) caused by the non- parabolicity in conduction band and electron spin resonance in symmetric and asymmetric confinement potentials. The asymmetric wells exhibit a strong deviation in behavior from the symmetric wells at low magnetic fields with far more spin splitting than expected from the bulk g-factor of InSb. In InMnAs/GaSb we observe light and heavy hole CR peaks which demonstrate the existence of delocalized p-like carriers. In addition, In order to increase our understanding of the dynamics of carriers and spins, we performed time resolved measurements such as time- resolved CR spectroscopy on undoped InSb QWs and time-resolved magneto-optical Kerr effect on InMnAs/GaSb. Our results are important for understanding the electronic and magnetic states in NGS. This work was performed in collaboration with M. B. Santos and R. E. Doezema at the Univ. of Oklahoma, J. Wang and J. Kono at Rice Univ., H. Munekata at Tokyo Institute of Technology, C. J. Stanton at the Univ. of Florida, and Y. H. Matsuda and N. Miura at the Univ. of Tokyo.