Abstract Submitted
for the MAR06 Meeting of
The American Physical Society

Spin dynamics in a GaAs quantum well with optically controlled charge density: localization vs. delocalization ZHIGANG CHEN, SAM CARTER, RUDOLF BRATSCHITSCH, STEVEN CUNDIFF, JILA, University of Colorado and National Institute of Standards and Technology, Boulder, CO 80309-0440, USA, PHIL DAWSON, School of Physics and Astronomy, Sackville St Building, University of Manchester, Manchester, M60 1QD, England — We have studied electron spin dynamics in a mixed type I/type II quantum well (QW) structure, which consists of narrow and wide GaAs QWs separated by AlAs barriers. The electron (hole) densities in the wide (narrow) QW can be varied continuously over a wide range by low power photoexcitation at an energy above the narrow QW bandgap. We have performed time-resolved Kerr rotation measurements in the Voigt geometry to probe the electron spin dynamics in the wide QW. We measure two g-factors for electron spin precession, which we ascribe to the localized and delocalized electrons in the wide QW. Photoexcited holes, localized by the well-width fluctuations in the narrow QW, bind and localize the electrons in the wide QW. A study of the spectral dependence shows strong inhomogeneity of the localized electron g-factor, while the delocalized electrons have a constant g-factor. With increasing carrier density, the precession amplitude of the delocalized (localized) electrons increases (decreases) until only the delocalized electron precession can be observed at high density.

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Date submitted: 30 Nov 2005 Electronic form version 1.4