Magneto Transport Measurements in Narrow Band Gap Semiconductors

Shabani, J.; Pennachio, D.; McFadden, T.; Palmstrøm, C. (UC Santa Barbara, CNSI, ECE and Materials Department)

Introduction

The hybrid superconductor-semiconductor systems combine the macroscopic superconducting properties of the superconducting leads with the microscopic degrees of freedom of the semiconductor. Recently proposals have predicted new phases of matter can emerge at this interface in the quantum Hall regime. During 2014, we studied properties of InAs heterostructures (Sm), NbTi superconducting (Sc) thin films and hybrid devices with Sc-Sm junctions in magnet lab in SCM1 system at 30 mK and magnetic fields up to 18 T.

Results and Discussion

Figure 1 highlights our main findings. We have studied several high mobility InAs heterostructures at low temperatures (as shown in Fig. 1(a,b)) and extracted different transport properties. We have studied integer and searched for fractional quantum Hall states in our samples. Figure 1c shows our bias spectroscopy on Sc-Sm junctions as a function of magnetic field. Our NbTi thin films have a critical field of 13.5 Tesla in the perpendicular direction. We observe an appearance of a zero bias peak in resistance in strong magnetic field below the critical field.

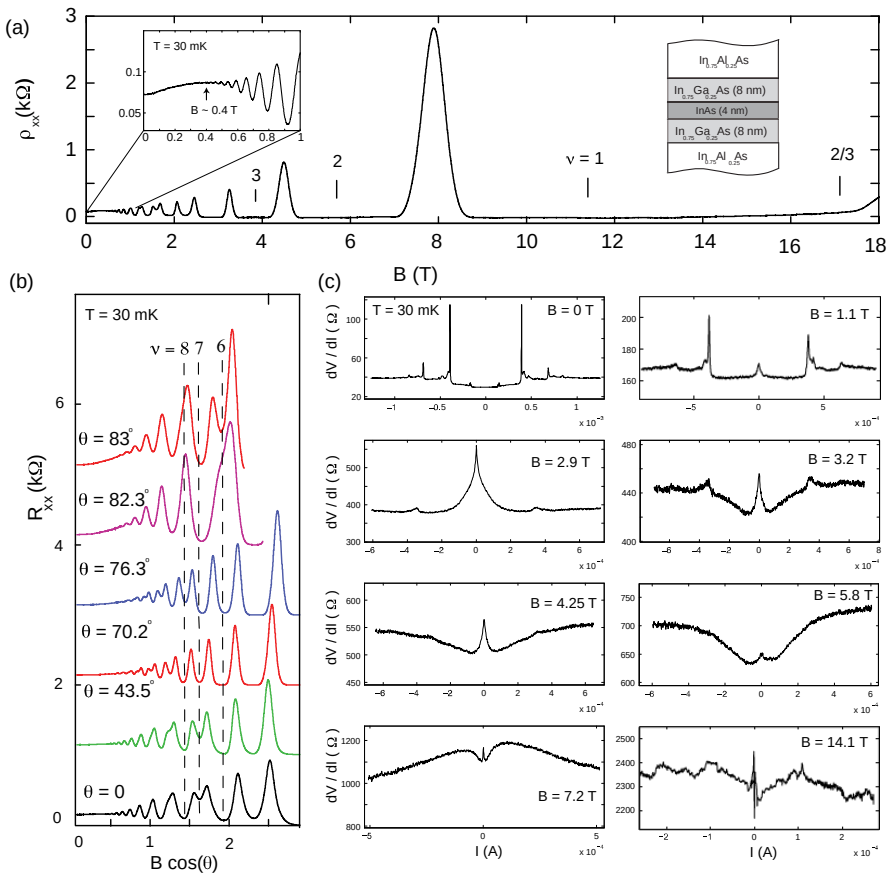

Figure 1: Magneto-resistance measurements where sample is (a) perpendicular to magnetic field (zero degree) (b) tilted with respect to total magnetic field (c) dV-dI measurement in an Sm-Sc junctions in perpendicular magnetic field.

Acknowledgements

This work was supported by Microsoft Research. We thank T. Murphy, J.H. Park, G. Jones and E. Palm for technical help. A portion of this work was performed at the National High Magnetic Field Laboratory, which is supported by National Science Foundation Cooperative Agreement No. DMR-1157490, the State of Florida, and the U.S. Department of Energy