Magnetotransport Properties of 2D Hole Gas in Compressively Strained Germanium Quantum Wells

T. Zou[1], A. Coschizza[1], C. Nademi[1], P. Waldron[2], M. Myronov[3], S. Studenikin[2], , J. B. Kycia[1]
[1] *Dept. of Physics & Astronomy, University of Waterloo, Waterloo, ON, N2L 3G1, Canada*
[2] *Security and Disruptive Technologies Research Centre, National Research Council Canada, Ottawa, ON, K1A 0R6, Canada*
[3] *Physics Dept., The* University *of Warwick, Coventry, CV4 7AL, UK*
t7zou@uwaterloo.ca

Strained germanium quantum wells have high hole mobility, tunable spin splitting, and small effective mass, which has promising applications in quantum computing devices such as spin qubits.[1,2] In this presentation, we describe measurements on undoped strained germanium 2D Hole Gas (2DHG) samples using Shubnikov-de Haas (SdH) and Hall Effect measurements at cryogenic temperatures. Previous work has been published on samples which showed a high mobility of $\mu = 4.3 \times 10^6 cm^2/(V \cdot s)$ at 300 mK[2]. In this work, we characterize the low-temperature transport properties of gated germanium 2DHG Hall bars. We identify and compare several features in the SdH measurements including negative magnetoresistance, spin splitting, and a varying background. Furthermore, we measured the effective mass, m^*, at different charge carrier concentrations. Finally, we describe the experimental setup and its configuration, which uses an adiabatic demagnetization refrigerator (ADR), in-house built superconducting magnet, and in-house built dry dilution refrigerator.

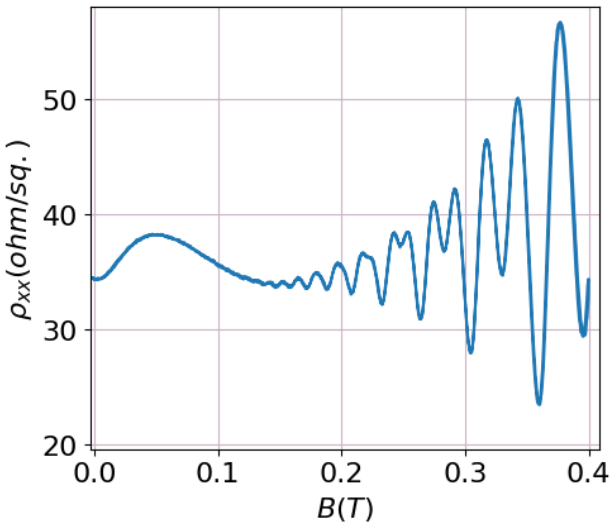

Fig. The low SdH oscillations of a Hall bar sample. T=200 mK.

References

[1] C. Morrison and M. Myronov, Appl. Phys. Lett. 111, 19 (2017)
[2] M. Maksym, J. B. Kycia, P. Waldron, W. Jiang, P. Barrios, A. Bogan, P. Coleridge, and S. Studenikin, Small Science 3, 4 (2023): 2200094.