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Magnetotransport of High Mobility Holes in Monolayer and Bilayer WSe_2[1]

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Transition metal dichalcogenides have attracted significant interest because of their two-dimensional crystal structure, large band-gap, and strong spin-orbit interaction which leads to spin-valley locking. Recent advances in sample fabrication [1] have allowed the experimental study of low temperature magneto-transport of high mobility holes in WSe_2 [2]. We review here the main results of these studies which reveal clear quantum Hall states in mono- and bilayer WSe_2. The data allows the extraction of an effective hole mass of $m^* = 0.45 m_e$ (m_e is the bare electron mass) in both mono and bilayer WSe_2. A systematic study of the carrier distribution in bilayer WSe_2 determined from a Fourier analysis of the Shubnikov-de Haas oscillations indicates that the two layers are weakly coupled. The individual layer density dependence on gate bias shows negative compressibility, a signature of strong electron-electron interaction in these materials associated with the large effective mass. We discuss the interplay between cyclotron and Zeeman splitting using the dependence of the quantum Hall state sequence on carrier density, and the angle between the magnetic field and the WSe_2 plane. Work done in collaboration with B. Fallahazad, H. C. P. Movva, K. Kim, S. K. Banerjee, T. Taniguchi, and K. Watanabe. [1] H. C. P. Movva *et al.*, *ACS Nano* **9**, 10402 (2015). [2] B. Fallahazad *et al.*, *Phys. Rev. Lett.* **116**, 086601 (2016).

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