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Electronic Structure and Carrier Transport in Graphene Bilayers[1]

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Graphene bilayers come in different varieties ranging from the micro-mechanically exfoliated Bernal stacked sheets where the strongly coupled layers act like a single electronic material, to the essentially decoupled turbostratic graphene bilayers observed in both epitaxial and CVD grown graphene. In this talk I will first review the experimental evidence and early theoretical understanding for the band structure of bilayer graphene. I will then discuss electrical transport measurements and present the semi-classical theory for carrier transport in bilayer graphene. I will show that close to the Dirac point, the co-existence of electron and hole carriers gives rise to an interesting interplay between disorder and temperature [1-3]. For example, we predict that knowing the strength of the disorder potential from low temperature conductivity measurements completely determines the temperature dependence of the conductivity. Detailed comparison with recent experiments highlights both the successes and the shortcomings of this theoretical model. Finally, I will examine the different factors influencing the transport in twisted graphene bilayers. For example, the breaking of inversion symmetry results in a charge imbalance between the two layers giving rise to unexpected features in magneto-transport.

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[2] S. Adam and M. D. Stiles,"Temperature dependence of the diffusive conductivity of bilayer graphene," *Phys. Rev. B*, **82**, 075423, (2010).

[3] S. Xiao, J. Chen, S. Adam, E. D. Williams, and M. S. Fuhrer, "Charged impurity scattering in bilayer graphene," *Phys. Rev. B*, **82**, 041406, (2010).

[1]This work was done in collaboration with Mark Stiles, Michael Fuhrer and Sankar Das Sarma.