Graphene devices and phenomena in the ultraclean limit.

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Two-dimensional materials offer a wide range of outstanding properties but are highly sensitive to disorder from the environment. We have developed a 'van der Waals transfer' technique to encapsulate graphene within crystalline h-BN with nearly perfect interfaces, and an 'edge contact' technique to achieve electrical contact to the encapsulated channel.[1] This provides graphene channels with ballistic transport over tens of microns at low T, offering a platform to explore a wide variety of phenomena and devices. This talk will summarize recent results in three areas: novel 'Hofstader Butterfly' physics [2]; demonstration of negative refraction at graphene p-n junctions [3]; and tunable interactions between in double-layer heterostructures of bilayer graphene that result in formation of an excitonic superfluid phase [4,5]

[1] L. Wang et al, Science 342, 614 (2013).
[2] L. Wang et al, Science 350, 1231-1234, (2015).
[3] S. Chen et al, Science (in press).
[4] J. Li, arXiv:1602.01039
[5] J. Li, arXiv:1608.05846