Contribution ID: **69** Type: **Poster**

Measuring correlated phases in encapsulated bilayer graphene via graphite contacts

Saturday, November 26, 2022 4:00 PM (2 hours)

Encapsulation of graphene into in hexagonal Boron Nitride (hBN) has been central to a lot of the research done on graphene in the recent years. Furthermore, graphite top and bottom gates can be added to increase the sample quality. In Bernal stacked bilayer graphene, gate tuning allows to tune control the charge density as well as the out-of-plane electric field independently from one another, which led to the observation of many intriguing many-body phases. Recently, a cascade of new correlated phases including Stoner half and quarter metals [1-3], correlated insulators [1] and superconductivity [2] were revealed at large electric fields in trigonal warped bilayer graphene.

These findings have led to an increased interest in further research on exploring the complex phase diagram of Bernal bilayer graphene. The extent in to which this phase space can be further explored addressed is amongst other parameters however limited by the maximum electric field and thus by the maximum values of gate voltages that can be applied to the sample without breaking through the dielectric. With the aim of increasing these maximum voltages, we have explored the method of using graphite contacts to contact bilayer graphene flakes within van-der-Waals heterostructures [1]. Using graphite contacts instead of commonly used 1D edge contacts [4] removes the necessity to etch into the hBN flakes. This etching process would locally reduce the thickness of the dielectric and had therefore previously been a limiting factor for the applied electric fields.

[1] Seiler, A. M. et al., Nature 608, 298–302 (2022)
[2] Zhou, H. et al. Science 375, 774-778 (2022)
[3] de la Barrera, S. C. et al. Nature Physics 18, 771–775 (2022)
[4] Wang, L. et al. Science 342, 614-617 (2013)

Category

Solid State (Experiment)

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Session Classification: Poster session

Track Classification: Physics Posters