



## Microwave Absorption of Graphene in BN, Capacitively Coupled Through Graphite

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### Introduction

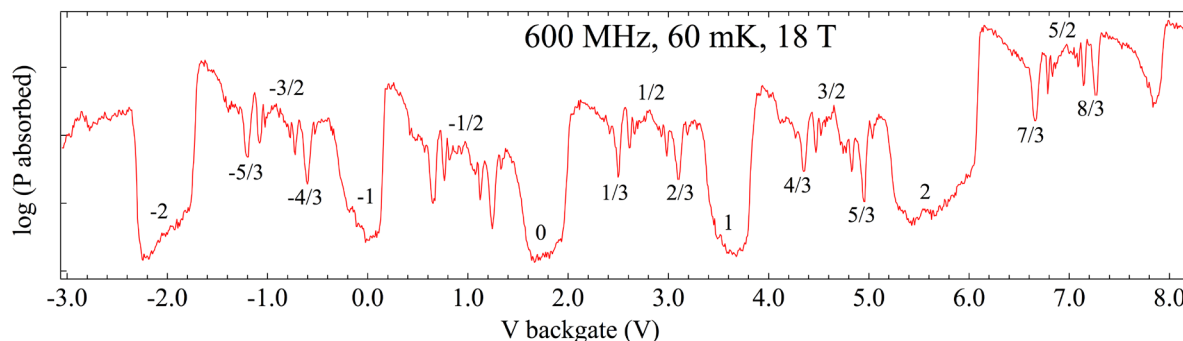
Recent work [1] has shown that edges are an important source of the disorder in graphene encapsulated in BN. In a sample whose edges are defined by graphite gates, ref. [1] showed signatures of many correlated electronic phases in DC transport. Among these states are some that exhibit a reentrant integer quantum Hall effect, which is usually associated with bubble phases. Bubble phases are solids with more than one carrier guiding center at each lattice site, and show strong pinning modes [2] in higher Landau levels in GaAs 2D electron systems. A pinning mode is a small oscillation of pieces of a pinned electron solid within the disorder potential.

### Results and discussion

Microwave measurements of graphene in BN involve small coplanar microwave transmission lines that capacitively couple to the graphene. To increase quality, and to seek the apparent bubble phases of ref. [1], we installed graphite coupling planes in the transmission lines. Owing to the high magnetoresistance of the graphite, these devices did not couple well at all frequencies in high field, so were not capable of spectroscopy. Nonetheless they gave good signal-to-noise at certain frequencies and exhibited many fractional states. A scan of microwave absorption vs. gate voltage is shown in the figure. The significance of the measurements is as an important step to broadband spectroscopy of ultralow disorder graphene, which may exhibit pinning modes.

### References

- [1] Chen, S.; Ribeiro-Palau, R.; Yang, K.; Watanabe, K.; Taniguchi, ; Hone, J.; Goerbig, M. O. and Dean, C. R. , <https://lanl.arxiv.org/abs/1811.07094>, July 2018.  
[2] Lewis, R. M.;Ye, P. D.; Engel, L. W.; Tsui, D. C. ; Pfeiffer, L. N. and West, K. W., Phys Rev Lett, **89**, (2002).



**Fig.1** Microwave power absorbed vs. backgate voltage for graphene in BN, coupled to by graphite planes. Landau level filling factors are marked.