Anomalous optical response of graphene on hexagonal boron nitride substrates

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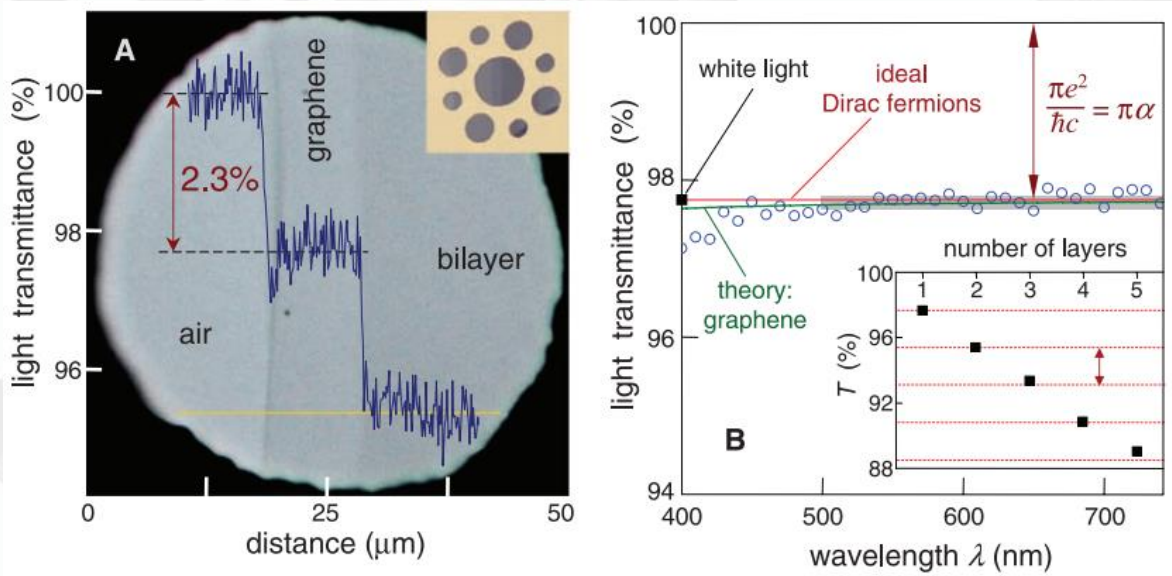
SFM-Conference, Saratov, 29th of September 2022

Center for Photonics and 2D Materials

Graphene's Optical Response, Inception

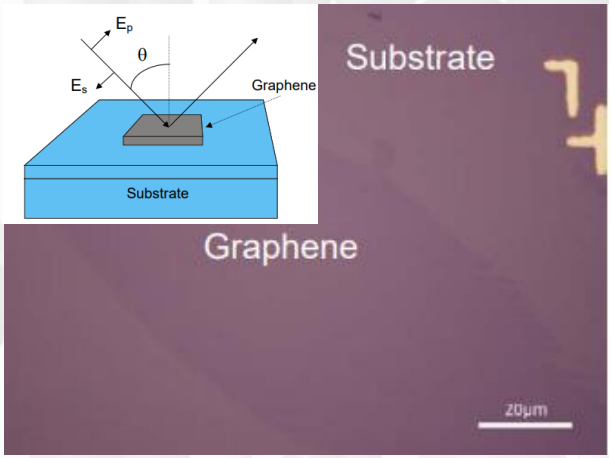
Transmittance

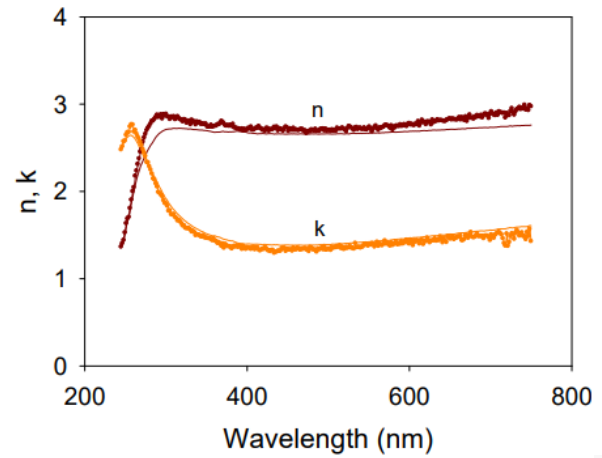


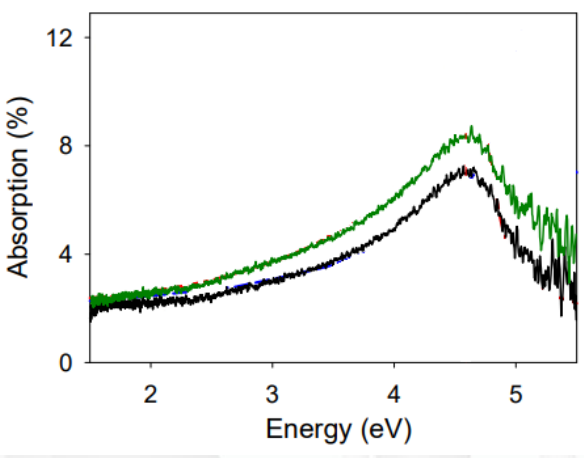
- ✓ *Fine-structure constant determines the optical response of free-standing graphene.*
- ✓ *Fine-structure constant also determines the optical response of Si/SiO2 supported graphene.*

Adapted from R. R. Nair et al., Science '08

Spectroscopic ellipsometry



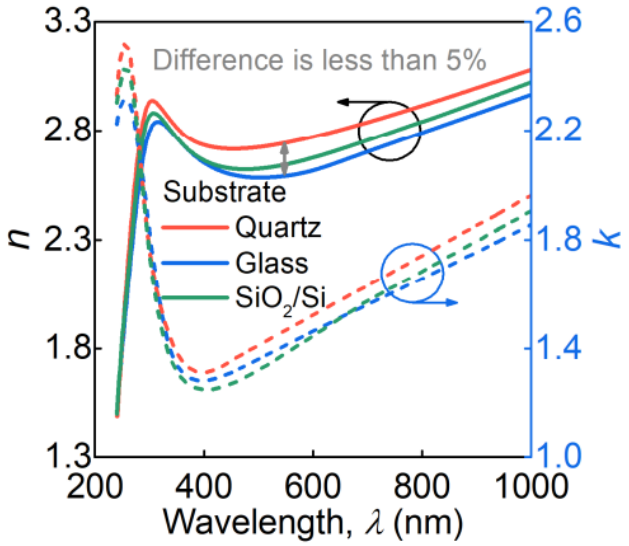


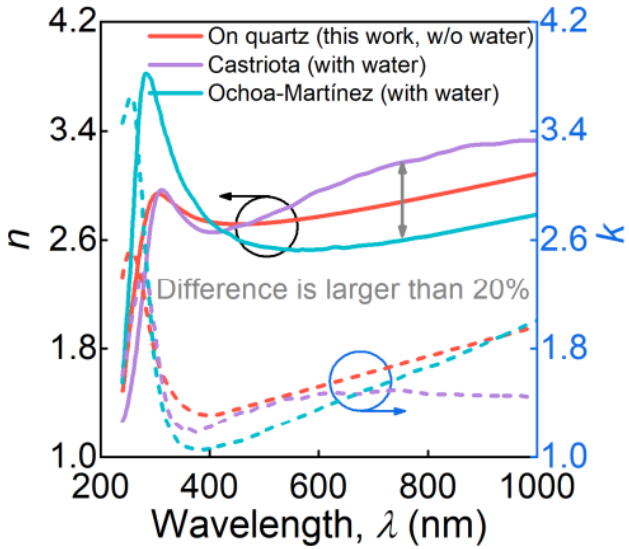


Adapted from V. G. Kravets et al., PRB '10

Graphene by M. I. Katsnelson, Cambridge University Press '12

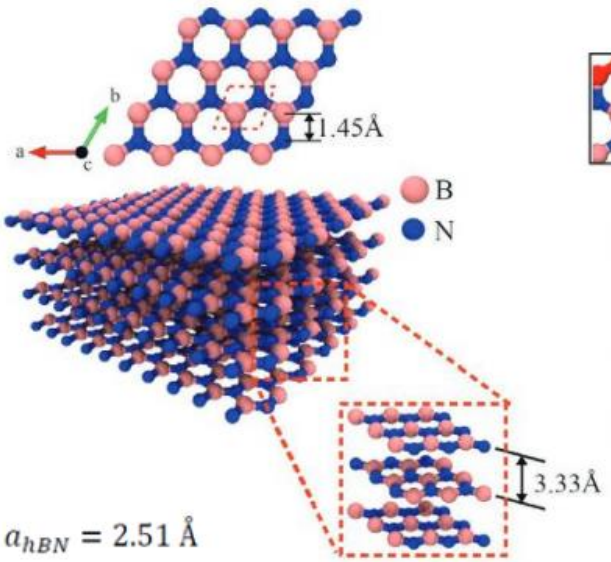
Spectroscopic Ellipsometry of Graphene on Standard Substrates

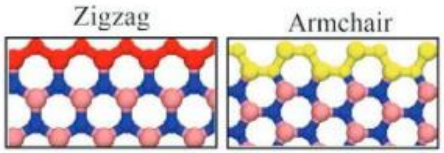


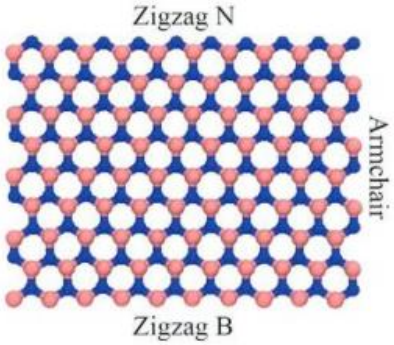


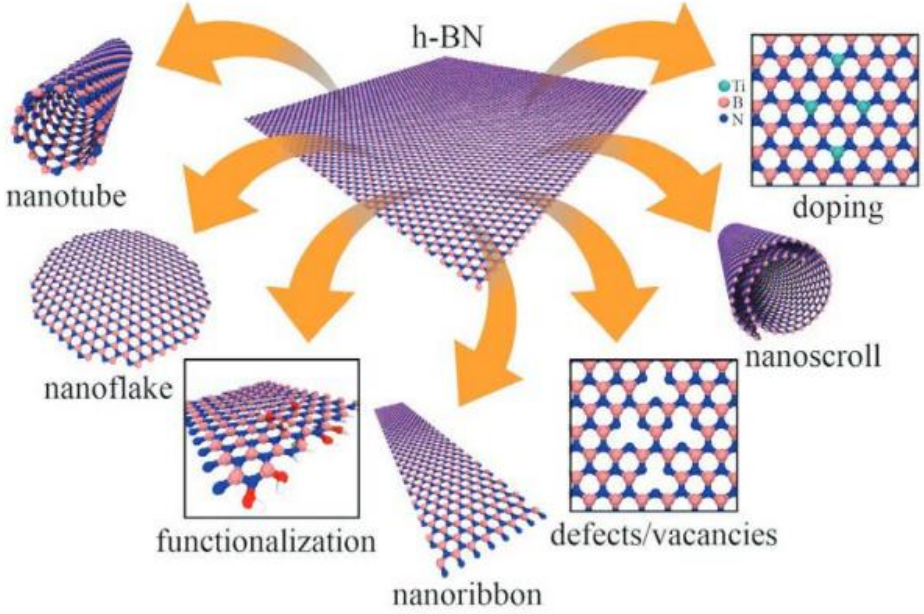
Adapted from M. A. El-Sayed et al., Nano. '21

hBN's Fundamentals

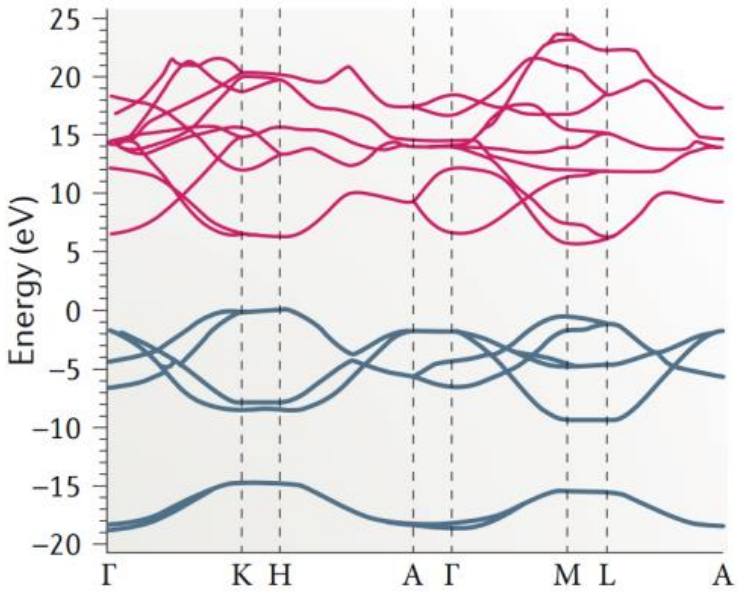


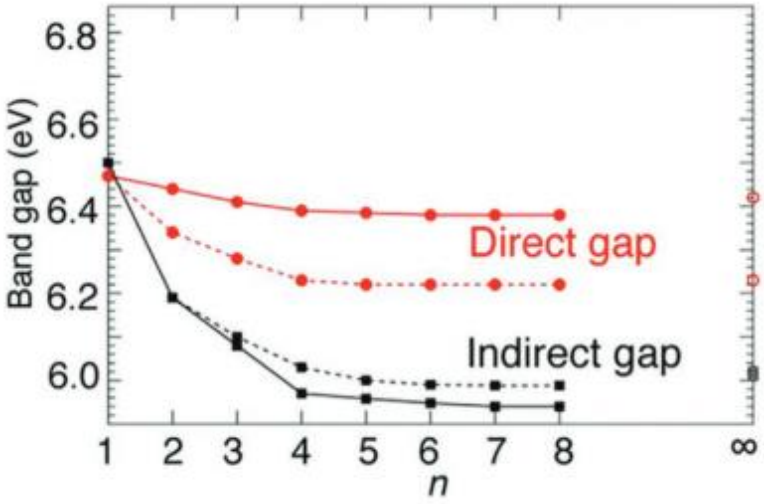






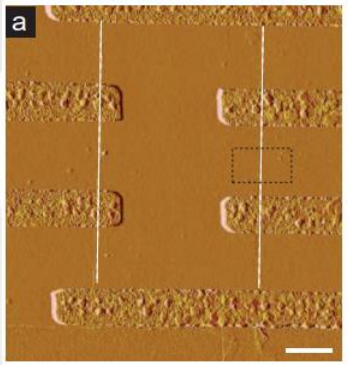
First-principle calculations

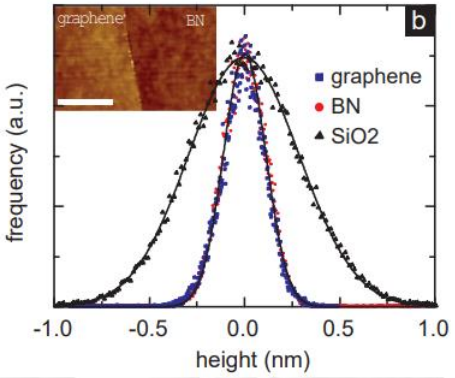


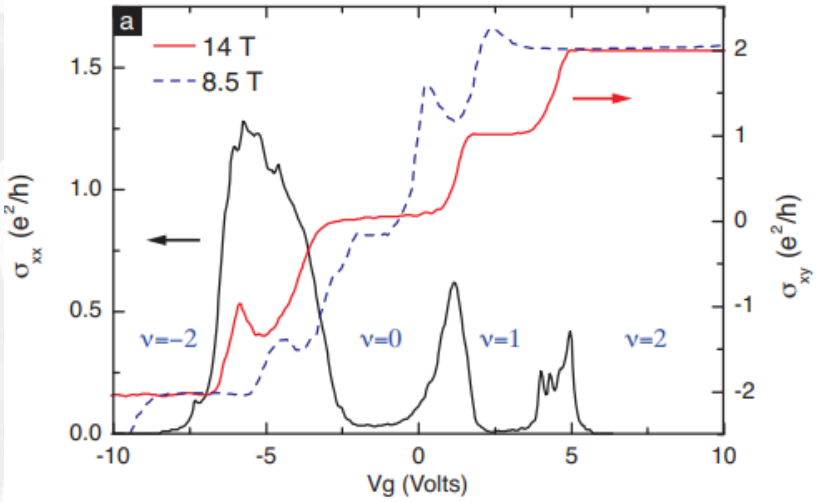


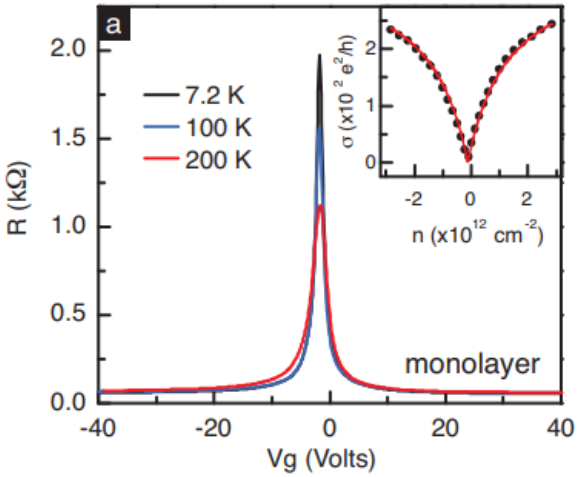
Adapter from J. D. Caldwell et al., Nat. Rev. Mat. '21

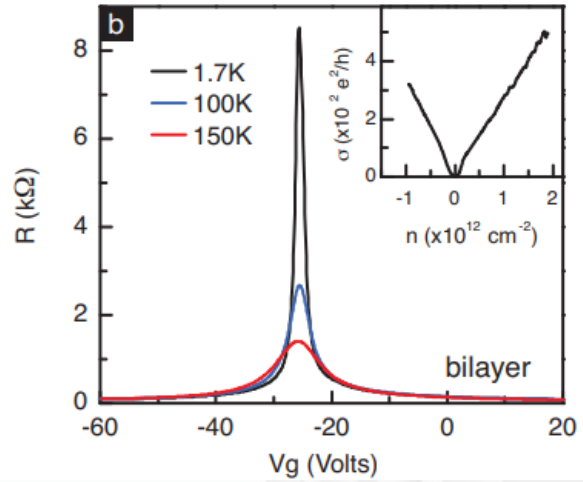
hBN Substrates for Graphene Electronics, Inception

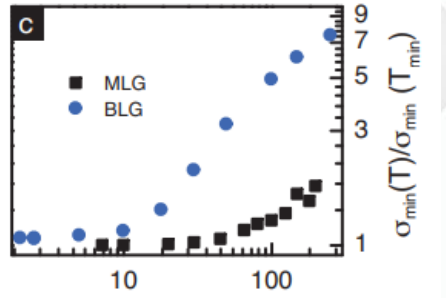


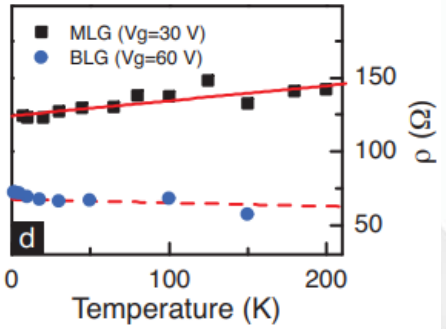


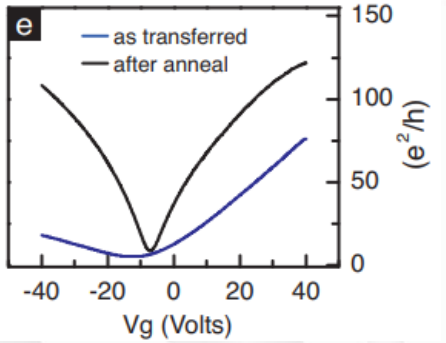






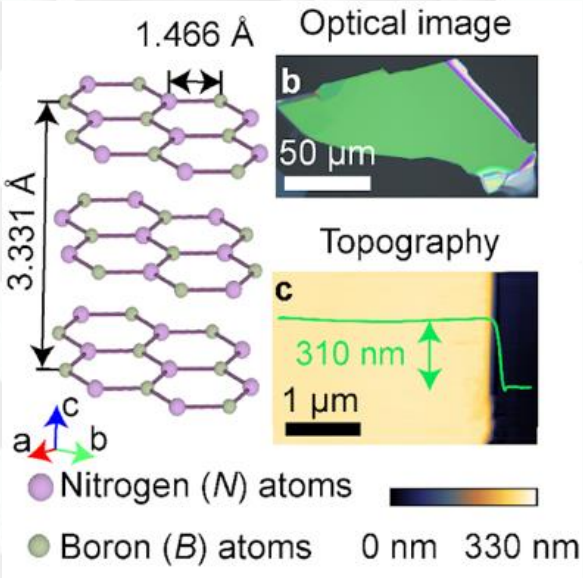


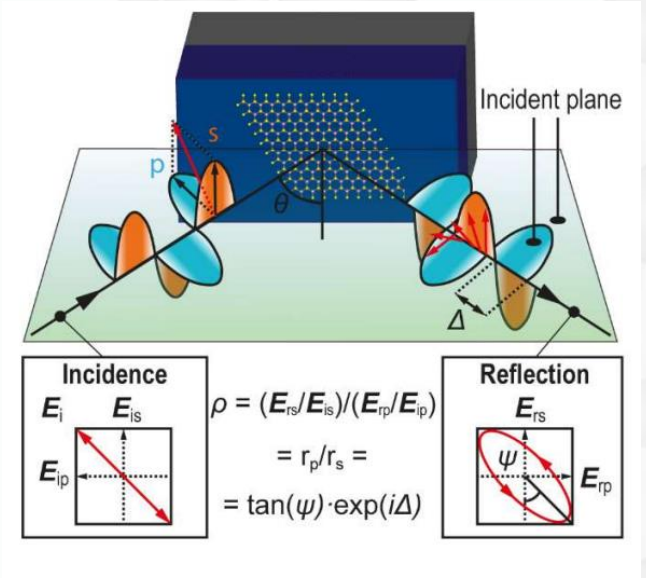




Adapter from C. R. Dean et al., Nat. Nano '10

Rigorous optical response of bulk hBN





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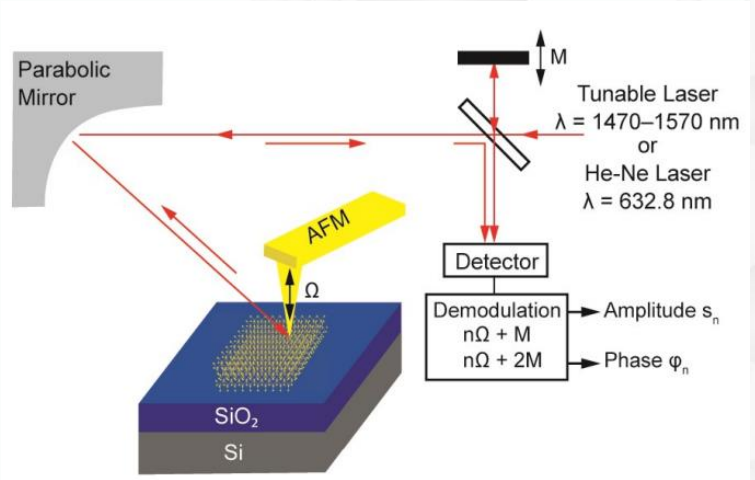
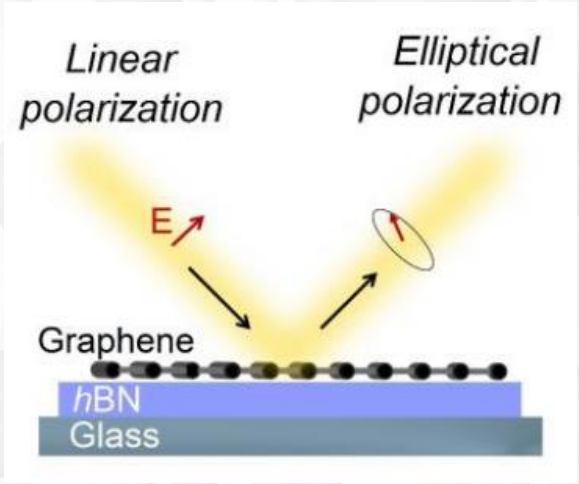
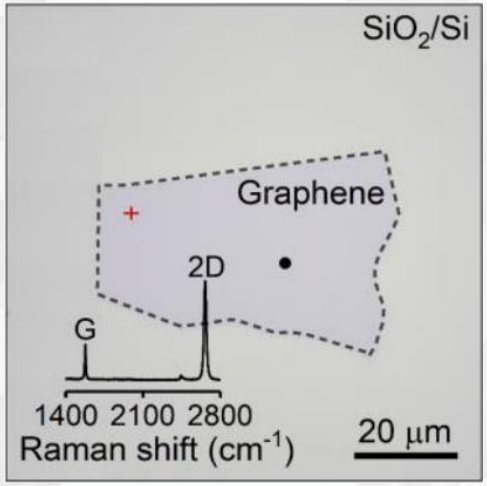
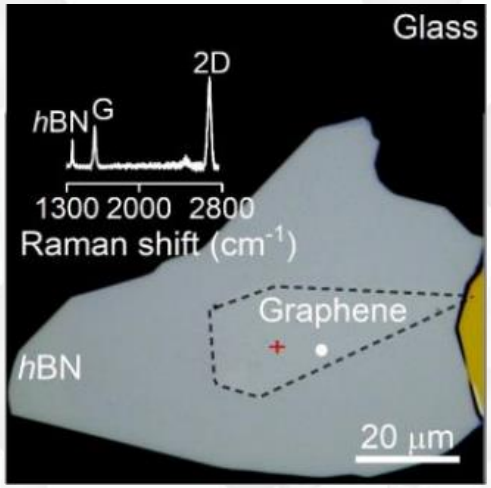
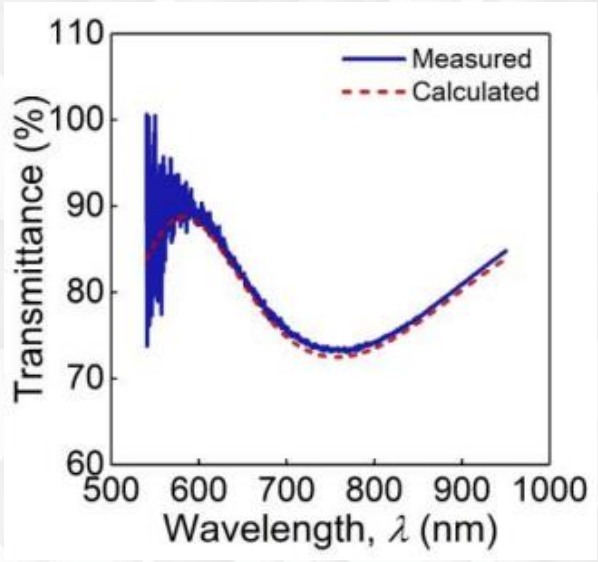


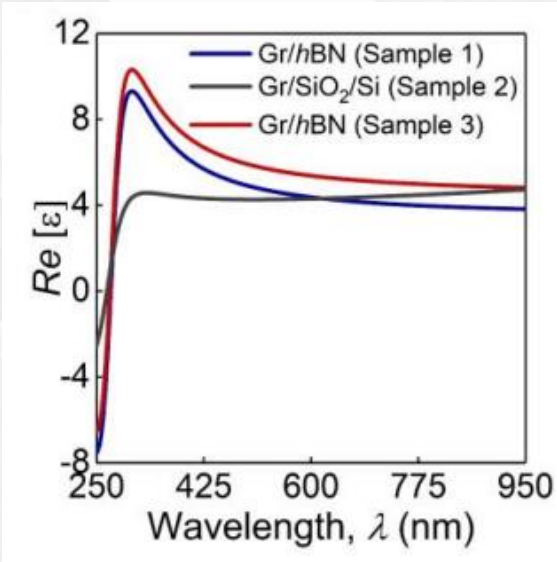
SE Response from hBN Supported Graphene

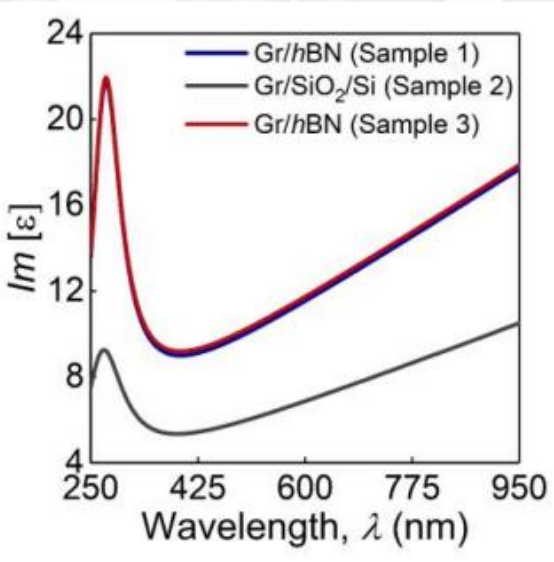




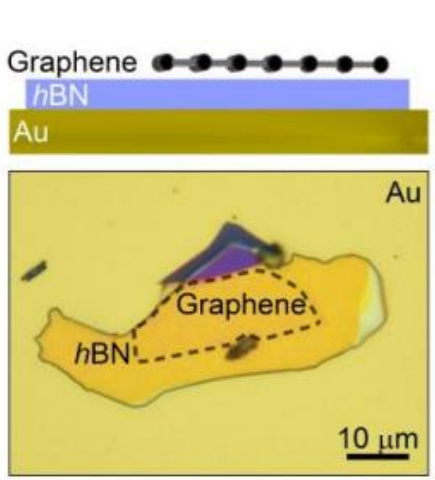


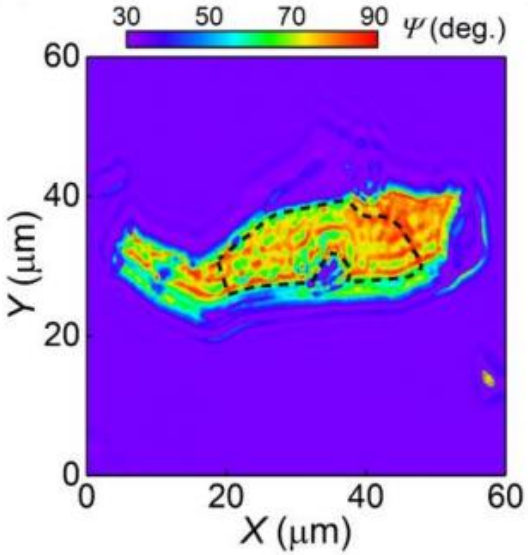


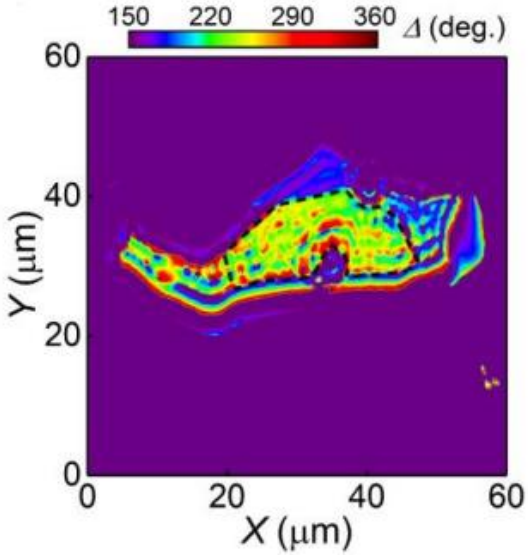


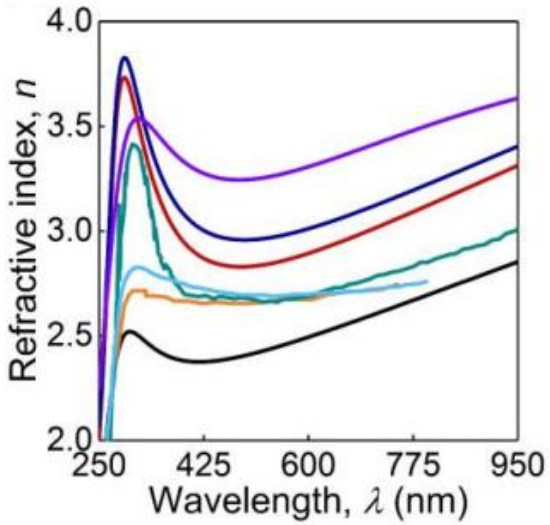


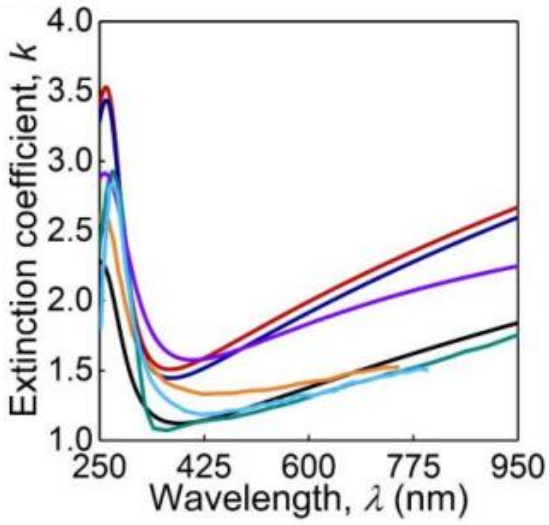
High-sensitive SE Approach (to be extended to other 2D Ms)

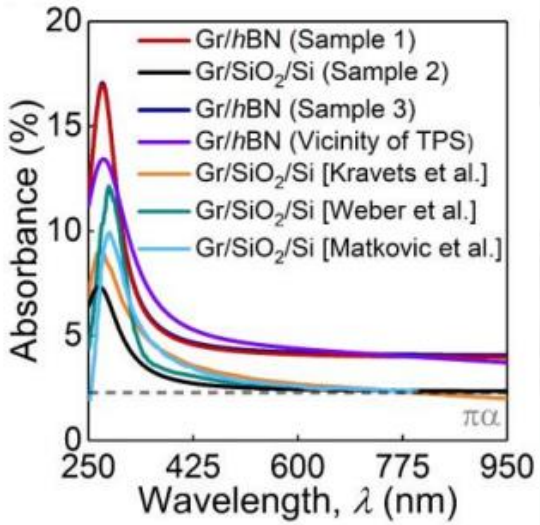












✓ *Graphene's absorption on hBN may exceed the one of graphene on SiO2/Si by about 60%*

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Volkov V.

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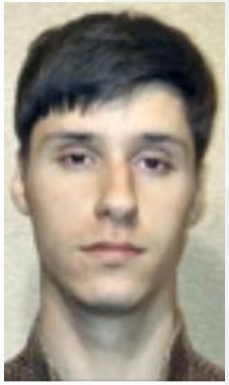
Kvashnin D.

Yakubovsky D.

Ermolaev G.

Slavich A.

Toksumakov A.



Begichev I.

Tatmyshevskiy M.

Klishin Yu.

THANK YOU FOR YOUR ATTENTION

SFM-Conference, Saratov, 29th of September 2022