Nanoscale Optical Imaging of Graphene using s-SNOM

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Real-space visualisation of the Dirac plasmons propagating along graphene was for the first time achieved using the neaSNOM infrared near-field microscope [1, 2]. Graphene plasmon interference mapping allows the extraction of local material properties, e.g. conductivity, intrinsic doping, defects. Direct control of propagating surface plasmons on graphene with resonant antennas and conductivity patterns was also demonstrated using the same s-SNOM technology [3, 4]. During this presentation, photocurrent measurements on graphene, simultaneously recorded with optical and AFM images will be shown [5]. Furthermore, Mid-infrared probing of the conductivity dynamics in single and multi-layer graphene using ultrafast near-infrared excitation of electrons will be presented [6]. For further investigations, the prospect of low-temperature s-SNOM promises to give insight into the mechanisms of plasmon-polariton damping [7]. This talk will introduce our cryo-neaSNOM closed-cycle low temperature s-SNOM, which makes it possible to study plasmonic materials at sample temperatures below 10 K [8].

References

[1] Z. Fei et al., Nature, 487 (2012) 82
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[4] M. B, Lundeberg et al., Nature Mat. 16 (2016), 204
[5] A. Woessner et al., Nature Comm. 7 (2016), 10783
[6] M. Wagner et al., Nano Lett. 14 (2014) 4529
[7] G. Ni et al., Nature 557 (2018) 530
[8] W. Luo et al., Nature Comm. 10 (2019) 2774

Figures

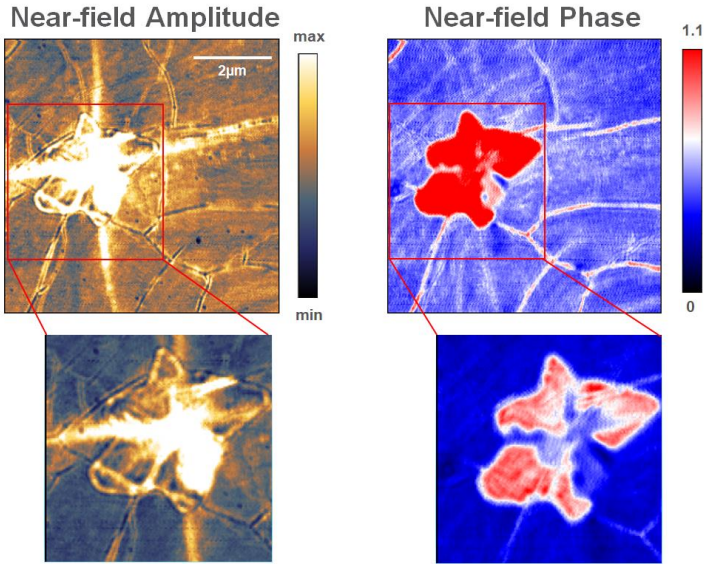

Figure 1: Amplitude and phase-resolved plasmon interference optical near-field mapping of graphene at 930 cm^{-1} and at 8.5 K.