Acoustic THz graphene plasmons revealed by photocurrent nanoscopy

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The interaction of terahertz (THz) radiation with graphene has a vast application potential in many technologies, including imaging, communications, sensing, or photo-detection, among others. Recently, it has been shown that the excitation of localized THz plasmons in graphene can strongly enhance light-matter interactions, opening the door to more efficient optoelectronic devices. Here, we will present on the first visualization of propagating graphene plasmons (GPs) at THz frequencies, which can also be controlled by metallic (split) gates. Intriguingly, due to the coupling of GPs with the metal gate underneath we observe a linearization of the plasmon dispersion (thus revealing acoustic plasmons), which comes along with an extreme confinement of the plasmon fields [1]. These extraordinary GPs properties are very promising for sensing and communication technologies. To map the THz GPs, we introduce nanoscale-resolved THz photocurrent nanoscopy as a novel tool for studying fundamental and applied aspects of local THz photocurrent generation with a resolution of 25 nm, nearly 4 orders of magnitude below the diffraction limit.

References

[1] P. Alonso-González, A. Y. Nikitin, Y. Gao, A. Woessner, M. B. Lundeberg, A. Principi, N. Forcellini, W. Yan, S. Vélez, A. J. Huber, K. Watanabe, T. Taniguchi, L. E. Hueso, M. Polini, J. Hone, F. H. L. Koppens, and R. Hillenbrand, *Nature Nanotechnology*, doi:10.1038/nnano.2016.185, (2016).