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Exciting and probing plasmons in graphene by local defects ANATOLY EFIMOV, KIRILL VELIZHANIN, Los Alamos Nationonal Laboratory —
The short wavelength of collective excitations, i.e., plasmons, in doped graphene (∼10-20 nm) is very attractive for multiple applications. However, the same short wavelength makes photoexcitation of plasmons in graphene a very challenging task. In this work, we discuss various types of local defects including semiconductor quantum dots, metallic nanoclusters, edges and holes in graphene as means to "squeeze" the large wavelength of optical excitation down to the nanometer scale, thus, providing an effective coupling between free photons and plasmons in graphene. In the case of semiconductor quantum dots, we show how plasmons in graphene can be excited and probed by Forster resonance energy transfer from the optically excited quantum dot to the graphene sheet. Specifically, we demonstrate how the calculated dispersion relation of plasmons in graphene as well as of other electronic excitations can be accurately extracted by controlling the backgate voltage and the distance between the quantum dot and graphene [1].

[1] K. A. Velizhanin, A. Efimov "Probing plasmons in graphene by resonance energy transfer," Phys. Rev. B, 085401, 84 (2011).

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