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# Graphene as a tunable plasmonic material

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Graphene is a novel plasmonic medium whose electronic and optical properties can be conveniently controlled by electrostatic gates. Near-field nano-imaging shows that at technologically relevant infrared frequencies common graphene/Si oxide/Si back-gated structures support surface plasmons with wavelength of the order of 200 nm and the propagation length several times this distance. Such plasmons represent concentration of electromagnetic energy on the spatial scale two orders of magnitude smaller than the photon wavelength. Both the amplitude and the wavelength of the plasmons are shown to be tunable by the gate voltage. Plasmon standing waves arise when plasmons launched by a sharp tip of a scanned probe interfere with their reflection off sample edges and inhomogeneities. These interference patterns are shown to depend on the location of the tip and the shape of the sample. Theoretical modeling provides quantitatively accurate description of the plasmonic interference patterns. Plasmonic dispersion and damping, extracted from the spatial decay of the interference fringes sheds light on the exotic electrodynamics of Dirac quasiparticles in graphene.

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