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Electromagnetic interaction of graphene with nanoparticles: applications to nanoscale imaging spectroscopy and plasmonics L.M. ZHANG, A.H. CASTRO NETO, Boston U, MICHAEL FOGLER, UCSD — Interaction of graphene-covered substrate with a nearby nanoscale particle is studied theoretically. Graphene is shown to induce broadening and frequiency shifts of electromagnetic resonaces (cavity modes) localized near the particle. The effect is strongly enhanced for substrates that possess narrow surface polariton excitations. In turn, the coupling to polaritons modifies the spectrum of graphene plasmons. The theory is applied to model scanning near-field optical microscopy (SNOM) experiments where the role of nanoparticle is played by the sharp tip of the scanned probe. The origin of the extraordinary fine spatial resolution of SNOM is explained and proposals for detecting the novel modes by SNOM in the infrared and THz domains are outlined. Also discussed are other applications, including infrared and Raman scattering from graphene covered by a layer of colloidal nanoparticles.

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