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Tunable plasmons in atomically thin gold nanodisks[1] ALEJANDRO MANJAVACAS, Rice University, JAVIER GARCIA DE ABAJO, ICFO-The Institute of Photonic Sciences — The ability to modulate light at high speeds is of paramount importance for telecommunications, information processing, and medical imaging technologies. This has stimulated intense efforts to master optoelectronic switching at visible and near-infrared (vis-NIR) frequencies, although coping with current computer speeds in integrated architectures still remains a major challenge. Here [1] we show that atomically thin noble metal nanoislands can extend optical modulation to the vis-NIR spectral range. We find plasmons in thin metal nanodisks to produce similar absorption cross-sections as spherical particles of the same diameter. Using realistic levels of electrical doping, plasmons are shifted by about half their width, thus leading to a factor-of-two change in light absorption. These results are supported by a microscopic quantum-mechanical calculations based on the random-phase approximation (RPA), which we compare with classical simulations obtained solving Maxwell's equations using tabulated dielectric functions. Both approaches result in an excellent agreement for nanodisks with diameters above 13 nm, although quantum confinement and nonlocal effects play an important role for smaller sizes. [1] A. Manjavacas and F.J Garcia de Abajo, Nat. Commun. (2014).

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