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Near-field spectroscopy of optically doped graphene

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Scattering near-field infrared spectroscopy with its spatial resolution in the 20 nm region is an ideal spectroscopic tool to study graphene. Our previous work has revealed important insight in the SiO2 substrate graphene interaction and showed an enhancement and blueshift of the SiO2 surface phonon resonance in the mid-infrared spectral region due to plasmon phonon coupling [1]. Additionally, pronounced plasmonic effects occurred in the form of standing wave patterns near interfaces and boundaries in single- and bilayer graphene for ungated and gated samples [2]. Here we extend our previous studies and report on optically induced effects for single- and bilayer graphene on SiO2 substrates. 100 fs near-infrared laser pulses are used to change the carrier density of graphene via optical pumping before probing the sample's mid-infrared scattering near-field response. We analyze the effects on the hybrid plasmon-phonon system with respect to the pump power and time-delay between pump and probe pulses. [1] Z. Fei et al., Nano Lett. 11, 4701 (2011). [2] Z. Fei et al. arXiv:1202.4993

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