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Linear plasmon dispersion in single-wall carbon nanotubes and the collective excitation spectrum of graphene

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We have measured a strictly linear π plasmon dispersion along the axis of individualized single wall carbon nanotubes and a fully localized viz. non-dispersive plasmon in crossed geometry [1]. The optical limits of the on-axis and crossed π plasmon dispersion meet the two distinct peak positions, that were observed in polarized optical absorption spectroscopy [2]. The plasmon dispersions in isolated nanotubes are completely different from plasmon dispersions of graphite or bundled single wall carbon nanotubes. *Ab initio* studies on graphene based systems allow us to reproduce the different dispersions. This suggests that individualized nanotubes provide viable experimental access to collective electronic excitations of graphene, and it validates the use of graphene to understand electronic excitations of carbon nanotubes. In particular, the calculations reveal that crystal local field effects (LFE) cause a mixing of electronic transitions, including the 'Dirac cone'and resulting in the observed linear dispersion.

[1] C. Kramberger, et al. PRL **in print** (2008)
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