Graphene nano-photonics and carrier dynamics

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Graphene, a two-dimensional sheet of carbon atoms, has recently emerged as a novel material with unique electrical and optical properties, with great potential for novel opto-electronic applications, such as ultrafast photo-detection, optical switches, strong light-matter interactons etc. In this talk I will review the new and strongly emerging field of graphene nano-photonics. In particular, I will show how to exploit graphene as a host for guiding, switching and manipulating light and electrons at the nanoscale [1,2]. This is achieved by exploiting surface plasmons: surface waves coupled to the charge carrier excitations of the conducting sheet. Due to the unique characteristics of graphene, light can be squeezed into extremely small volumes and thus facilitate strongly enhanced light-matter interactions. Additionally, I will discuss novel types of hybrid graphene photodetectors [3] and new results on carrier dynamics in graphene. By studying the ultrafast energy relaxation of photo-excited carriers after excitation with light of varying photon energy, we find that electron-electron scattering dominates the energy relaxation cascade rather than electron-phonon interaction [4]. This solves a long-standing debate on the relative contribution of electron-electron scattering versus optical phonon emission.

References

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