Graphene quantum nano-optoelectronics

Frank Koppens ICFO, Spain

Optics and opto-electronics of graphene is one of most vibrant, rapidly developing and exciting areas which has already led to some commercial applications. Rather than being just another new photonic material, it combines a wide palette of unique aspects which promise breakthroughs in several outstanding problems of nanophotonics and optoelectronics, including broadband photodetection and sensing, on-chip manipulation of nanoscale optical fields and lasing.

In this talk, the most recent developments of graphene nano-photonics and photoconversion for near-infrared and infrared frequencies are being reviewed. Strong interactions between graphene and nanoscale light-emitters are controlled and detected by tuning graphene from an absorbing to plasmonic material. Additionally, we discuss the role of electron interactions on the photoconversion processes. Using techniques from solid-state cavity quantum electrodynamics (QED) to strongly couple graphene to optical fields, we discuss new avenues in quantum information processing, imaging, and sensing.

