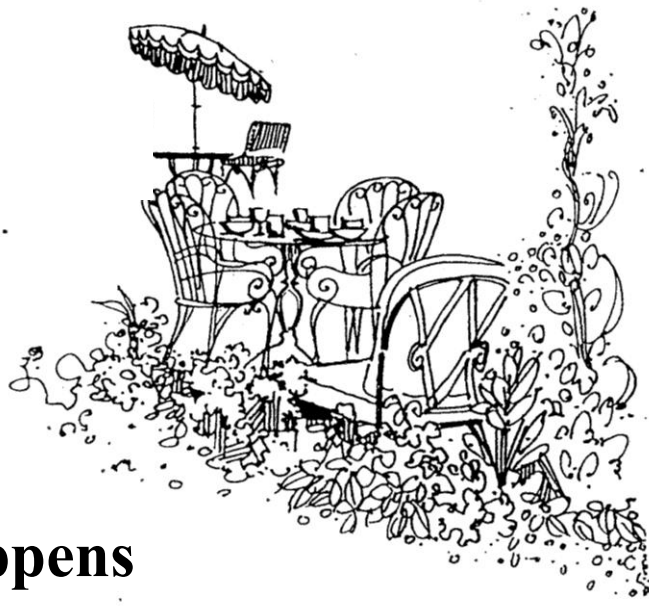
Chez Pierre

Presents ...

Monday, March 19, 2012
12:00pm
MIT Room 4-331



Frank Koppens
ICFO- The Institute of Photonic Sciences

"Graphene: a novel platform for capturing and manipulating light at the nanoscale"

The ability to manipulate optical fields and the energy flow of light is central to modern information and communication technologies, as well as quantum information processing schemes. However, as photons do not possess charge, controlling them efficiently by electrical means has so far proved elusive. A promising way to achieve electric control of light could be through plasmon polaritons - coupled excitations of photons and charge carriers – in graphene. In this two-dimensional sheet of carbon atoms, it is expected that plasmon polaritons and their associated optical fields can be readily tuned electrically by varying the graphene carrier density. In the first part of this talk, I will discuss recent experiments revealing propagating optical plasmons in tapered graphene nanostructures [2], using near-field scattering microscopy with infrared excitation light [1].
The second part of the talk is devoted to a novel hybrid graphene-quantum dot photodetector [3] which exhibits a gain mechanism that can generate multiple charge carriers from one incident photon. We demonstrate a a record-high responsivity of 10^7 A/W and our devices also benefit from gate-tunable sensitivity and speed, spectral selectivity from the short-wavelength infrared to the visible, and compatibility with current circuit technologies.

References

[1] J. Chen, M. Badioli, P. Alonso-González, S Thongrattanasiri, F Huth, J Osmond, M. Spasenovic, A. Centeno, A. Pesquera, P. Godignon, A. Zurutuza, N. Camara, J. Garcia de Abajo, R. Hillenbrand, F. Koppens, "Optical nano- imaging of gate-tuneable graphene plasmons", arXiv 1202.4996 (2012)
[2] F. Koppens, D. Chang, J. García de Abajo, "Graphene Plasmonics: A Platform for Strong Light–Matter Interactions", Nano Letters 11, 3370–3377 (2011).
[3] G. Konstantatos, M. Badioli, L. Gaudreau, J. Osmond, M. Bernechea, P. Garcia de Arquer, F. Gatti, F. Koppens, "Hybrid graphene-quantum dot phototransistors with ultrahigh gain", Nature Nanotechnology (in print). See also arXiv 1112.4730 (2011).