Chez Pierre

Presents ...

Monday, April 13, 2009
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MIT Room 4-331

Dr. Frank Koppens

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“Near-field Electrical Detection of Optical Plasmons and Single Plasmon Sources”

Photonic circuits based on surface plasmons (SPs) are promising for the integration with nanoscale electronic circuits because they can be miniaturized below the optical wavelength scale. Moreover, the strong field confinement of SPs can be used to significantly modify the emission properties of individual emitters, which allows for single light quanta to be controlled. Such control has potential applications such as efficient photon collection, single-photon switching and long-range optical coupling of quantum bits.

However, there is a general tradeoff between the localization of an SP and the efficiency with which it can be detected with conventional far-field optics. To address this issue, we integrated a plasmonic waveguide with a nanoscale transistor, and demonstrated all-electrical SP detection in the near-field. Moreover, we show that the emission from a single-photon emitter can be directed very efficiently into SPs that propagate along a metallic wire. We used this strong coupling to perform all-electrical detection of the plasmon emission from an individual colloidal quantum. These results enable new on-chip optical sensing applications and fulfill a key requirement for “dark” electroplasmonic nanocircuits, in which SPs can be generated, manipulated, and detected without involving far-field radiation.