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Near-field Electrical Detection of Optical Surface Plasmons and Single Plasmon Sources FRANK KOPPENS, Department of Physics, Harvard University, A. FALK, C. YU, K. KANG, N. DE LEON, A. AKIMOV, M. JO, M. LUKIN, H. PARK — Surface plasmon polaritons (SPs) are a promising basis for nanoscale photonic circuits and allow for strong coupling between single photon emitters and propagating plasmon modes. 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. In this talk, I will discus a nanoscale all-electrical SP detection technique based on the near-field coupling between propagating surface plasmons and a nanowire field-effect transistor. The detection scheme consists of an Ag nanowire (NW) crossing a Ge NW field-effect transistor. The Ag NW guides SPs to the Ag/Ge junction, where they are converted to electron-hole (e-h) pairs and detected as current through the Ge NW. We use our detectors to electrically detect the plasmon emission from an individual colloidal quantum dot coupled to a SP waveguide. The detectors are highly efficient (0.1 electrons/plasmon), and a plasmonic gating effect can be used to amplify the signal even higher (up to 50 electrons/plasmon). These results enable new and efficient on-chip optical sensing applications and fulfill a key requirement for 'dark' optical frequency nanocircuits in which SPs can be generated, manipulated, and detected without involving far-field radiation.

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