Nano-Focusing of Light with Plasmonic Fiber Probes for Nanoscale Imaging

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The direct interfacing of optical fiber to metallic nanoantenna has widespread application in nanoscale imaging, optical lithography, nanoscale lasers, quantum communication, in-vivo sensing, and medical surgery.

In this talk, I will present our recent development of plasmonic fiber nano-probes for nanoscale chemical imaging. I will report on the design, fabrication, and characterization of an integrated fiber-tip assembly that functions for both the excitation and collection of light at the nanoscale. We report on the fabrication of a needle-shaped plasmonic nanoantenna on the end facet of an optical fiber using electron beam-induced evaporation of metal. We demonstrate the coupling of light from the fiber waveguide mode to the subwavelength nanoantenna plasmonic mode focusing down to the apex of the plasmonic needle using a polarization-resolved far-field side scatter imaging technique. Our work provides an important step toward the widespread application of optical fibers in nearfield spectroscopic techniques such as tip-enhanced Raman and fluorescence microscopy, single-photon excitation and quantum sensors, nano-scale optical lithography, and lab-on-fiber devices.