Generating a sub-nm-confined optical field in a nanoslit waveguiding mode

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Generating an optical field with tighter spatial confinement is always of great interest in both fundamental research and technological applications. Conventional approaches to ultratight optical field confinement are usually limited by optical diffraction limit, huge plasmonic loss or electron tunneling. Here we propose to generate a sub-nm-confined optical field in a nanoslit waveguiding mode in a coupled nanowire/nanofiber pair (CNP). Based on a strong mode coupling-enabled nanoslit waveguide mode, a sub-nm-confined optical field can be generated with a cross-sectional size down to ~0.3 nm (i.e., better than λ/1000) and a peak-to-background intensity ratio higher than 20 dB in the visible and infrared ranges. The nanoslit waveguide mode of the CNP can be launched by a tapered optical fiber with high efficiency within a broad spectral range. Owing to the low group velocity dispersion, the approach is also valid for ultrafast pulsed operation. Our results may open up new opportunities for studying light-matter interaction down to the sub-nm scale, as well as for exploring ultra-high-resolution optical technology ranging from super-resolution nanoscopy to atom/molecule manipulation.

Short Bio:
Limin Tong received his PhD degree from Zhejiang University, China. He is a Changjiang Distinguished Professor of Zhejiang University and a New Cornerstone Investigator. His research interests are in nanophotonics and fiber optics, with an emphasis on nanofiber/nanowire photonics and devices including nanoscale optical sensors, modulators and lasers.