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Enhanced and Resonant Transmission of Light through Dielectric-filled Subwavelength Waveguides[1] HUIZHONG XU, PANGSHUN ZHU, HAROLD G. CRAIGHEAD, WATT W. WEBB, School of Applied and Engineering Physics, Cornell University, Ithaca, NY 14853 — We analyze transmission of light through dielectric-filled subwavelength waveguides in a metal using both analytical and numerical methods. Our analysis revealed that a propagating mode can in principle exist in a waveguide of arbitrarily small size when a certain relationship between the dielectric constants of the metallic cladding and filling material is satisfied. Transmission through a subwavelength aperture of finite length can be further enhanced when the length is such that Fabry-Pérot-like resonances are excited. Strong, localized near-field intensity at the exit can be achieved with this mechanism for aperture diameters down to $\sim \lambda/20$. We will describe potential applications of this resonantly enhanced transmission phenomenon in near-field scanning optical microscopy and single-molecule spectroscopy.

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Huizhong Xu
School of Applied and Engineering Physics, Cornell University, Ithaca, NY 14853

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