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Role of Cylindrical Surface Plasmons in Enhanced Optical Transmission MICHAEL HAFTEL, Naval Research Laboratory, CARL SCHLOCKERMANN, GIRSH BLUMBERG, Bell Laboratories, Lucent Technologies — We investigate the role of cylindrical surface plasmons in enhancing the optical transmission from nanoarrays of dielectric coaxial cylinders embedded in a metal film. Finite difference time domain (FDTD) simulations identify transmission peaks at long wavelengths as being associated with the fields produced by the individual coaxial cylinders, and these peaks move out to increasingly long wavelengths as the dielectric ring becomes narrower. An analysis of cylindrical surface plasmon dispersion relations show that these peaks are due to resonances from surface plasmons propagating on the cylindrical metal-dielectric interfaces whose wave functions increasingly overlap as the ring narrows. The counterintuitive behavior of the wavelength of the peak is a direct consequence of the negative dielectric constant of the metal film and would not occur for a perfectly conducting or dielectric film. This resonant surface plasmon mechanism closely accounts for the dependence of the position of the simulated transmission peaks on ring geometry and the length of the coaxial cylinders.

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