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Controllable evanescent field coupling between metallic bilayers of subwavelength apertures Z. MARCET, J. PASTER, H. B. CHAN, University of Florida, D. W. CARR, Symphony Acoustics, J. E. BOWER, R. CIRELLI, F. P. KLEMENS, W. M. MANSFIELD, J. F. MINER, C. S. PAI, J. A. TAYLOR, Bell Labs — The optical transmission through a periodical array of subwavelength apertures in a metal film can be extraordinarily high due to resonance of the incident light with surface excitations, accompanied by dramatic enhancement of the local electromagnetic field on the metal surfaces. We have fabricated subwavelength slit arrays in two layers of metal. The two layers are positioned sufficiently close to each other so that the evanescent fields couple strongly at resonance. Depending on the lateral shift between the two layers, the transmission changes from near zero to a value that exceeds single layer transmission. Moreover, the phase delay of the transmitted light depends strongly on the lateral shift. We present both numerical simulations and experimental data to demonstrate that by tuning the lateral shift, an extra phase delay of π can be introduced while the transmission remains near maximum. The controllable phase delay in bilayer subwavelength structures opens new capabilities that cannot be achieved with single layers.

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