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Dependence of transmission resonances on the lateral shift in bilayer subwavelenth metallic hole arrays Z. MARCET, H.B. CHAN, University of Florida, Z.H. HANG, C.T. CHAN, Hong Kong University of Science and Technology, J.E. BOWER, R. CIRELLI, F.P. KLEMENS, W.M. MANSFIELD, J.F. MINER, C.S. PAI, J.A. TAYLOR, Bell Labs — Periodic subwavelength hole arrays in a metal film exhibit enhanced optical transmission at wavelengths where surface excitations are at resonance with the incident light. We fabricated double layer metal films, with identical periodic arrays of subwavelength holes in the two layers. When the two metal films are placed in sufficiently close proximity, two types of transmission resonances emerge. For the surface plasmon mode, the electromagnetic field is concentrated on the outer surface of the entire metallic layer stack. In contrast, for the gap resonance, also known as the guided mode, the field is confined to the gap between the two metal layers. Our measurements indicate that as the two layers are laterally shifted from perfect alignment, the peak transmission frequency of the guided mode decreases significantly, while that of the surface plasmon mode remains largely unchanged, in agreement with numerical calculations.

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