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Localized Plasmons of Nanometric Holes in Thin Gold Films M. KALL, T. RINDZEVICIUS, Y. ALAVERDYAN, P. HANARP, D. SUTHERLAND, Applied Physics, Chalmers Univ. of Techn., 412 96 Goteborg, Sweden, A. DAHLIN, F. HOOK, Div. of Solid State Physics, Lund Univ., Box 118, 221 00 Lund, Sweden , J. GARCIA DE ABAJO, DIPC, 20018 San Sebastian, Spain, J. PRIKULIS, Inst. of Chemical Physics, Univ. of Latvia, Riga LV-1586, Latvia — We have investigated the optical properties of sub-wavelength (60-200 nm) holes in 20 nm thin Au films using extinction and elastic scattering spectroscopy [1]. The samples are prepared by colloidal lithography on glass and consist of either spatially isolated holes or disordered hole arrays with varying density. We show that single holes exhibit a well-defined optical resonance in the visible to near-infrared spectral region, which we assign to a localized surface plasmon (LSP) excitation. The hole LSP red-shifts with increasing hole size or with increasing refractive index of the surrounding medium, in analogy with LSP's in metal nanoparticles, but exhibit a pronounced blue-shift with decreasing hole density, possibly due an enhanced hole-hole coupling mediated via surface plasmon polaritons. Similar to particle plasmons or flat metal surfaces, the hole LSP can be used for biochemical sensing based on refractive index contrast. New results on single hole sensing [2] and biofunctionalization of holes using lipid vesicles [3] will be discussed. [1] J. Prikulis et al, Nano Letters 4, 1003-1007 (2004); [2] T. Rindzevicius et al., submitted ms.; [3] A. Dahlin et al., submitted ms.

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