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Perfect coupling of light to surface plasmons with ultra-narrow linewidths MAXIM SUKHAREV, Arizona State University, PAUL SIEVERT, TAMAR SEIDEMAN, JOHN KETTERSON, Northwestern University — We examine the coupling of electromagnetic waves entering a thin silver film that forms an oscillatory grating embedded between two otherwise uniform semi-infinite half spaces having identical dielectric constants. On reducing the grating period from the long wavelength limit we encounter signatures in the transmission, T, and reflection, R, coefficients associated with: 1) the symmetric surface mode, 2) the anti-symmetric surface mode, and 3) electromagnetic diffraction tangent to the grating; the first two can be regarded as generalized (plasmon) Woods anomalies while the third is the first-order conventional (electromagnetic) Woods anomaly. The energy density at the film surface is enhanced for wavelengths corresponding to these three anomalies, particularly for the antisymmetric plasmon mode in thinner films. When exciting with two waves entering from opposite directions we find that by adjusting the grating oscillation amplitude and fixing the relative phase of the incoming waves to be even or odd, T+R can be made to vanish for one or the other of the plasmon modes; this corresponds to perfect coupling (impedance matching) between the incoming light and these modes.

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