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Plasmons in the presence of Tamm-Shockley states with Rashba splitting at noble metal surfaces[1] ABDEL-KHALEK FARID, EUGENE MISHCHENKO — Au(111) or similar noble metal surfaces feature Tamm-Shockley surface states that are known to possess considerable spin-orbit splitting of the Rashba type of order $\Delta = 0.1$ eV. When interacting with an electromagnetic field such states are expected to have resonances when the frequency of the field is near the energy of the spin-orbit splitting Δ. They originate from the intersubband transitions between spin-split subbands and can be observed in the frequency dependence of the surface impedance. Plasmons in thin metal films are gapless and can be strongly affected by these spin resonances, acquiring significant modification of the spectrum when it intersects the $\omega = \Delta$ line. Finally, an interesting demonstration of the intersubband resonances can be achieved when metal films are coated with ionic dielectrics that have a frequency of longitudinal/transverse optical phonons above/below Δ. The dielectric function between the two optical phonon frequencies is negative which forbids propagation of conventional plasmon-polaritons. However, the presence of spin-orbit-split surface states allows plasmon-polaritons to exist in this otherwise forbidden range of frequencies.

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Abdel-Khalek Farid

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