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Thickness dependent plasmon excitation and damping in metallic thin films ZHE YUAN, SHIWU GAO, Department of Applied Physics, Chalmers University of Technology, Goethenburg — We present a theoretical study of collective plasmon excitation and lifetime in metallic thin films using a jellium model [1, 2]. The excitation spectra are calculated with linear response theory and time-dependent local density approximation. The plasmon energy dispersion follows qualitatively the classical electrodynamical model. For ultrathin films with a few atomic layers, the collective plasmon resonances evolve into single particle transitions at small momenta. The plasmon linewidth due to Landau damping is found to depend exponentially on the film thickness. Quantum oscillations are found in ultrathin films with a period that is about three times longer than the universal period $\lambda_F/2$ observed in many other quantities. This long period results from the dynamical Friedel oscillations in the collective excitation normal to the films. [1] Z. Yuan and S. Gao, Phys. Rev. B 73, 155411 (2006). [2] Z. Yuan and S. Gao, Surf. Sci. in press.

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