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## Quantum Confinement by Schottky Barriers and its Consequences

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Atomically uniform Pb and Ag films have been successfully grown on Si(111) and Ge(111), respectively, despite a large lattice mismatch in each case. The resulting Schottky barrier at the interface confines the electrons in the film to form quantum well states or subbands. The electronic structure of the film including the ground state wave function can be significantly different from the bulk case, leading to substantial variations in physical properties as a function of film thickness. These variations generally follow a damped oscillatory curve riding on an approximately $1/N^x$ baseline function, with the exponent $x$ often close to unity. The oscillatory behavior is similar to the shell effect associated with the periodic property variations of elements in the period table. This talk discusses the basic electronic structure of thin metal films as measured by angle-resolved photoemission and the connections to physical properties including the surface energy, thermal stability, density of states, electron-phonon coupling, etc. Quantum size effects can also affect morphological evolution during film growth and heat treatment. The Schottky barrier can be modified by the use of interfactants, and experimental results will be presented to illustrate the utility of this method for quantum control and engineering. In collaboration with M. Upton, D. Ricci, P. Czoschke, L. Basile, S. J. Tang, Hawoong Hong, J. J. Paggel, D.-A. Luh, and T. Miller.