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**First Observation of Quantum Size Effects in Metal Films on Insulator** HAWOONG HONG, Argonne National Laboratory, AARON GRAY, University of Illinois, Urbana-Champaign, RUQING XU, University of Illinois, Urbana-Champaign, T.-C. CHIANG, University of Illinois, Urbana-Champaign — Quantum size effects of metal films have been drawing lot of attention among surface science community. These quantum size effects have been reported for metal films on semiconductors and metals. Here the first observation of the quantum size effects in metal films on insulators will be reported. Pb thin films, which exhibit the most dramatic quantum-size-effects were chosen again for this effort. Sapphire (001) substrates were used after they were annealed at 1500 °C in air and cleaned in a UHV chamber by heating. X-ray diffraction was measured during and after the deposition-annealing processes. Most of the structural aspects observed with Pb on Si(111) also appeared in Pb films on sapphire. The preferred island heights (or magic heights) appeared as 7, 10, 12, 14 layers from the preliminary analysis. This contrasts the magic heights on the Si substrates (5, 7, 9,...). This difference is coming from the phase shifts of confined electrons through the different interfaces. This magic selection of island-heights stays quite strong even at elevated temperatures up to 200~300 °C. Time resolved 3-D reciprocal space mapping also showed very strong ordering between islands during deposition and annealing of the films.

Hawoong Hong  
Argonne National Laboratory

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