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The formation of a sharp metal-semiconductor interface for the growth of Quantum Size Effect islands[1] C.A. JEFFREY, P.F. MICELI, Dept. of Physics and Astronomy, University of Missouri-Columbia, E.H. CONRAD, R. FENG, School of Physics, Georgia Institute of Technology, C. KIM, Dept. of Physics and Research Inst. of Basic Sciences, Kyunghee University, Korea, P.J. RYAN, MU-CAT, Advanced Photon Source, Argonne National Lab — In order to form Quantum Size Effect (QSE) metal islands on semiconductors, a smooth island-substrate interface is necessary to set up the electron standing waves that lead to the new quantum confined states. How this occurs for the Pb-Si(111)7x7 system is a mystery because of the large lattice mismatch and the highly corrugated 7x7 reconstruction. To understand how QSE islands develop in this system we have performed structural Surface X-ray scattering measurements on the initial formation of Pb islands grown on Si(111). We show how a smooth Pb-semiconductor interface develops through a series of structural arrangements. Once a vertically disordered Pb monolayer is completed, second layer atoms nucleate fcc clusters. These clusters undergo a displacive transition lifting them above the Si adatoms. This allow the Pb islands to "float" above the Si substrate so that the first island layer is smooth, thus setting up the proper boundary condition for QSE.

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