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Collective Super-Diffusive Motion of the Pb Wetting Layer on Si(111) MICHAEL ALTMAN, K.L. MAN, M.M.T. LOY, Hong Kong University of Science and Technology, M.C. TRINGIDES, Iowa State University — An unusual mass transport behavior has been discovered in the Pb/Si(111) wetting layer. Mass transport is studied by observing non-equilibrium coverage profile evolution with low energy electron microscopy (LEEM). Equilibration of an initial coverage step profile does not exhibit the profile broadening and gradual, $x \sim t^{1/2}$, time-dependent evolution that is expected from classical considerations. Instead, the profile edge is displaced linearly in time, $x \sim t$, much faster than expected for thermally activated hopping and without dispersal. LEEM also reveals a wave-like disturbance in the wetting layer that propagates in the direction opposite the step profile motion. The Pb coverage that is left in the wake of this disturbance can be determined accurately and with high lateral resolution using selected-area LEED due to the Devil's Staircase (DS) phases in this system. The expanding wave converts an initial homogeneous DS phase with coverage $\theta > \theta_c$ to a final phase with $\theta_c = 1.25$ ML, thereby conserving mass across the initial step profile position. This identifies a collective super-diffusive motion of the Pb layer that can extend rapidly over macroscopic distances. Such motion may facilitate the remarkably efficient self-organization of uniform height, quantum size effect-induced Pb islands on Si(111).

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