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QSE growth and super-diffusive liquid-like motion in Pb/Si(111) at low temperature

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QSE are responsible for the formation of uniform height metal islands at low temperatures [1]. For Pb/Si the islands form unusually fast, within a few minutes as low as T $\sim$ 150K. With STM [1] X-ray scattering [2] and LEEM [3] it was found that this is due to the superdiffusive "liquid-like" motion of the dense wetting layer that moves collectively with constant speed. Unstable islands transform into stable islands as seen in STM movies with the wetting layer climbing the sides of the unstable islands to complete the next layer. X-ray scattering experiments have shown anomalous coarsening with faster kinetics for growth at higher flux rates [2]. This unusual motion is also directly seen by LEEM with the refilling of an initial vacant circular region generated by a laser pulse, evolving at constant speed x/t instead of the normal $x/t^{1/2}$ diffusive motion (with x the profile edge). An outgoing expanding front is observed whose boundary is the source of material that refills the vacant hole. The combined effect is to observe mass transport over macroscopic distances with unusual long range correlation between the outwards expanding "source" and the inward moving "sink" (the refilling edge), separated by more than 0.200mm. In collaboration with M. Hupalo, P.Miceli, E. Conrad and M. S. Altman.

[1] M. C. Tringides et al *Physics Today* **60**, No. 4, 50 (2007).
[2] C. A. Jeffrey et al Phys. Rev. Lett., 96 106105, 2006.
[3] K. L. Man, et al. Phys. Rev. Lett., 11036104–5, 2013.