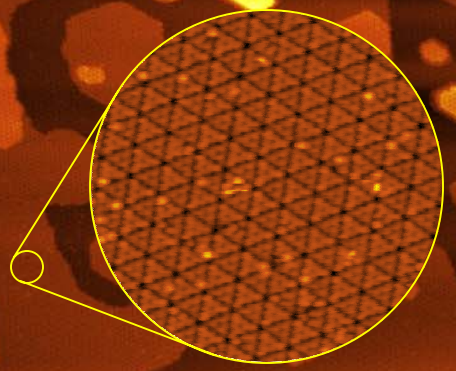
Multi-Scale Imaging of Epitaxial Growth

Peter and Eli Sutter, Colorado School of Mines, DMR-0208673

Scanning tunneling microscopy (STM) plays an important role in imaging of surfaces, e.g., to understand fundamental processes in thin film growth. STM routinely achieves atomic resolution, but only over a limited field of view, typically below 100 nm.

We have developed the capability of obtaining atom-resolved STM images of *very large sample areas* up to 2 μm in size, thus achieving an unprecedented combination of image statistics and detail across all length scales relevant to thin film growth processes.

In a first application of this novel experimental capability, we have identified a long-sought mechanism driving surface roughening in the growth of thin germanium films on silicon*. This result is a first step toward precise control to either promote roughness (e.g., for nanostructure formation) or suppress it (for applications requiring smooth surfaces or interfaces).



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Background image: 1.2 atomic layers of Ge on Si(111).Field of view 0.75×0.75 μm^2; atomic resolution at 0.05nm pixel spacing (inset).