Idealized Growth Modes in Homoepitaxy

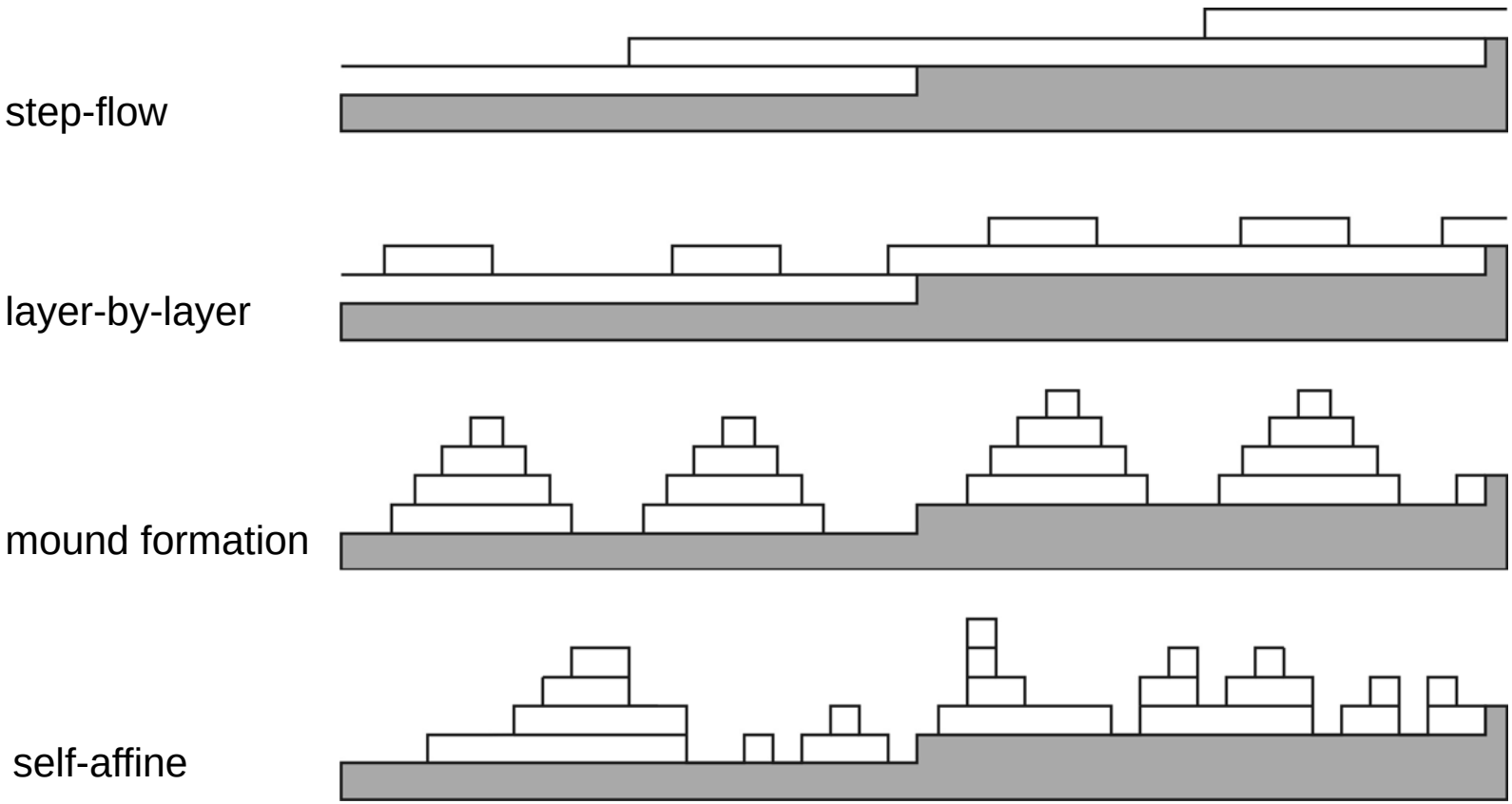


Fig. 6.20

Growth on Pt(111) - Overview

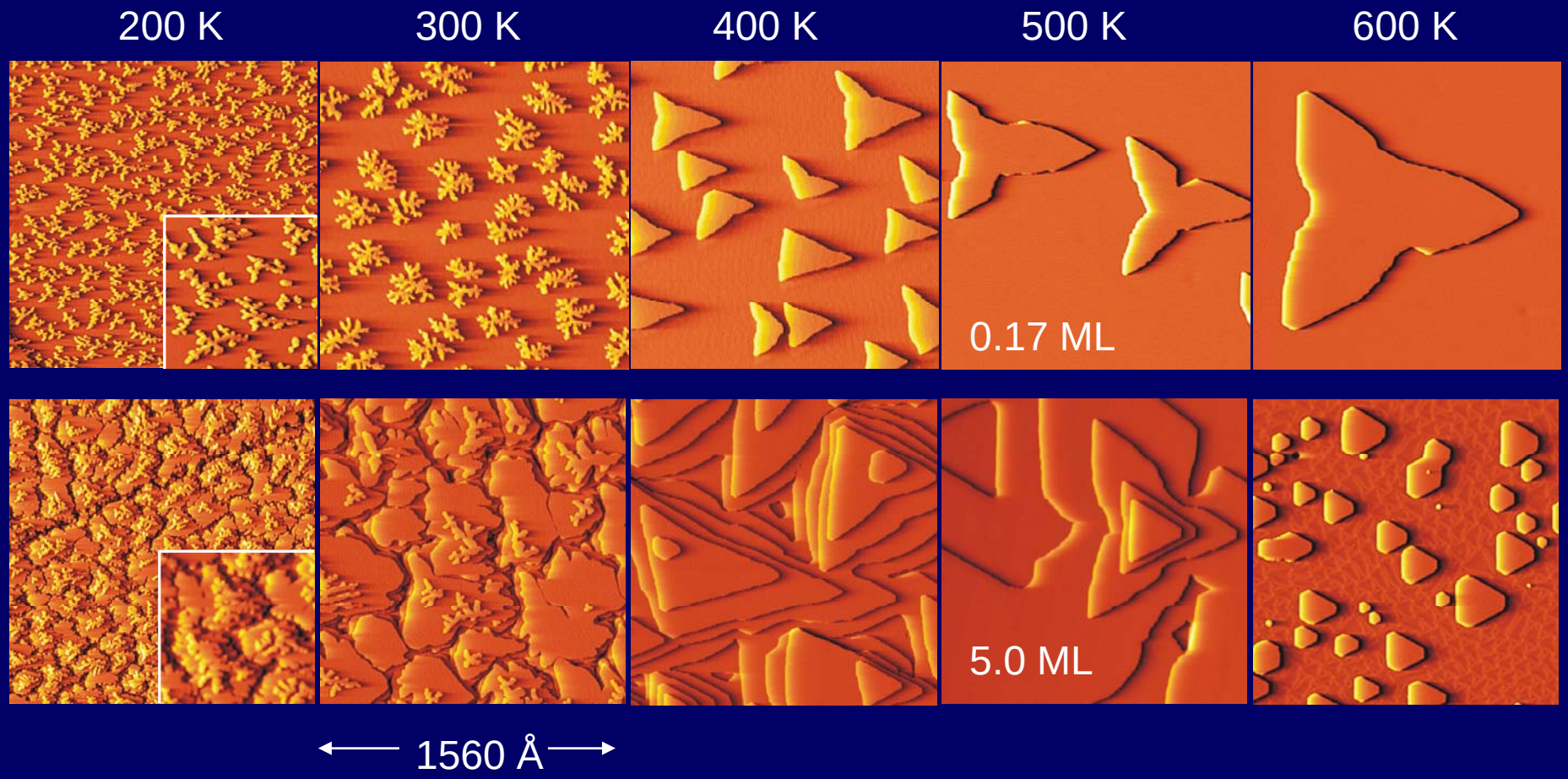
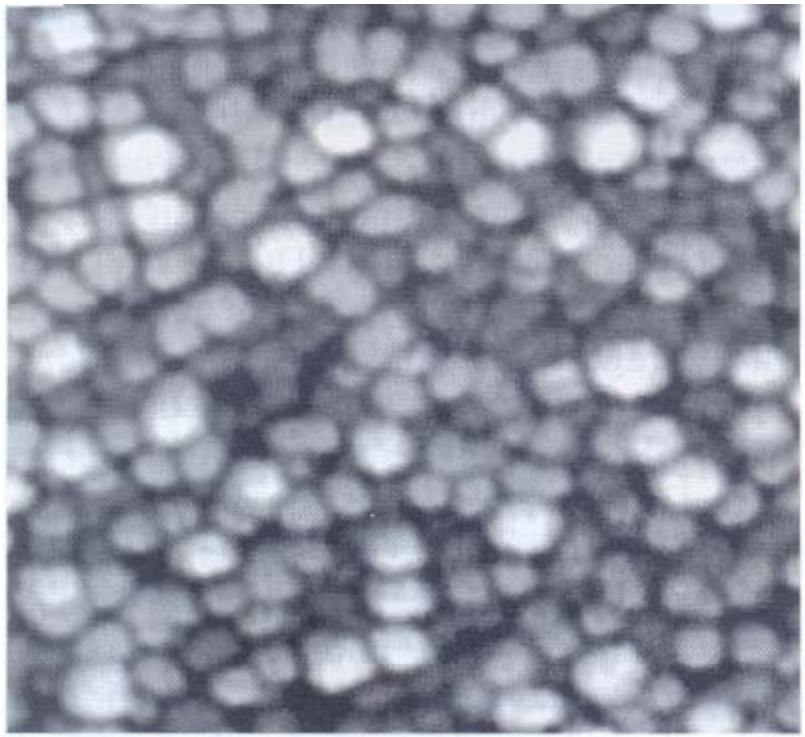


Fig. 6.21

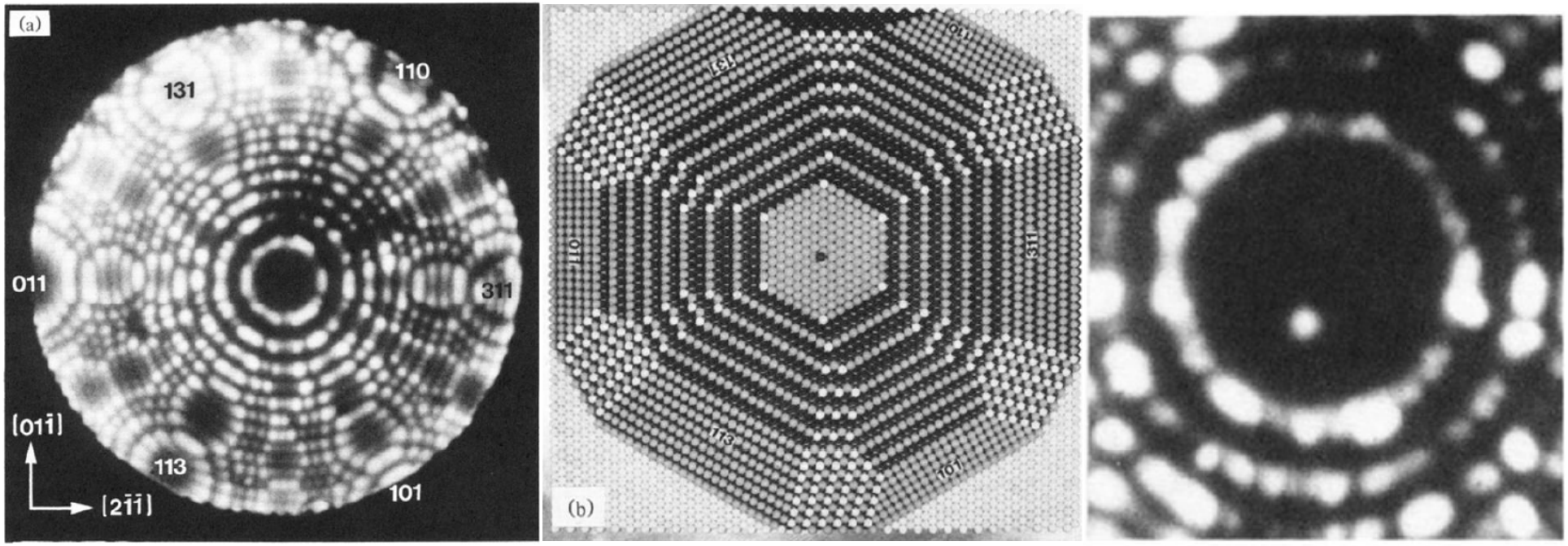
Absence of self-affine growth of Pt on Pt(111)



5 ML of Pt on Pt(111) deposited at 50 K (no diffusion possible).
Image size 35 nm x 35 nm.

Fig. 6.22

Diffusion of Ir adatoms on Ir(111); imaging with field ion microscopy



S.C. Wang, G. Ehrlich, Phys. Rev. Lett. 62 (1989) 2297

Fig. 6.23

Diffusion of Ir adatoms on Ir(111)

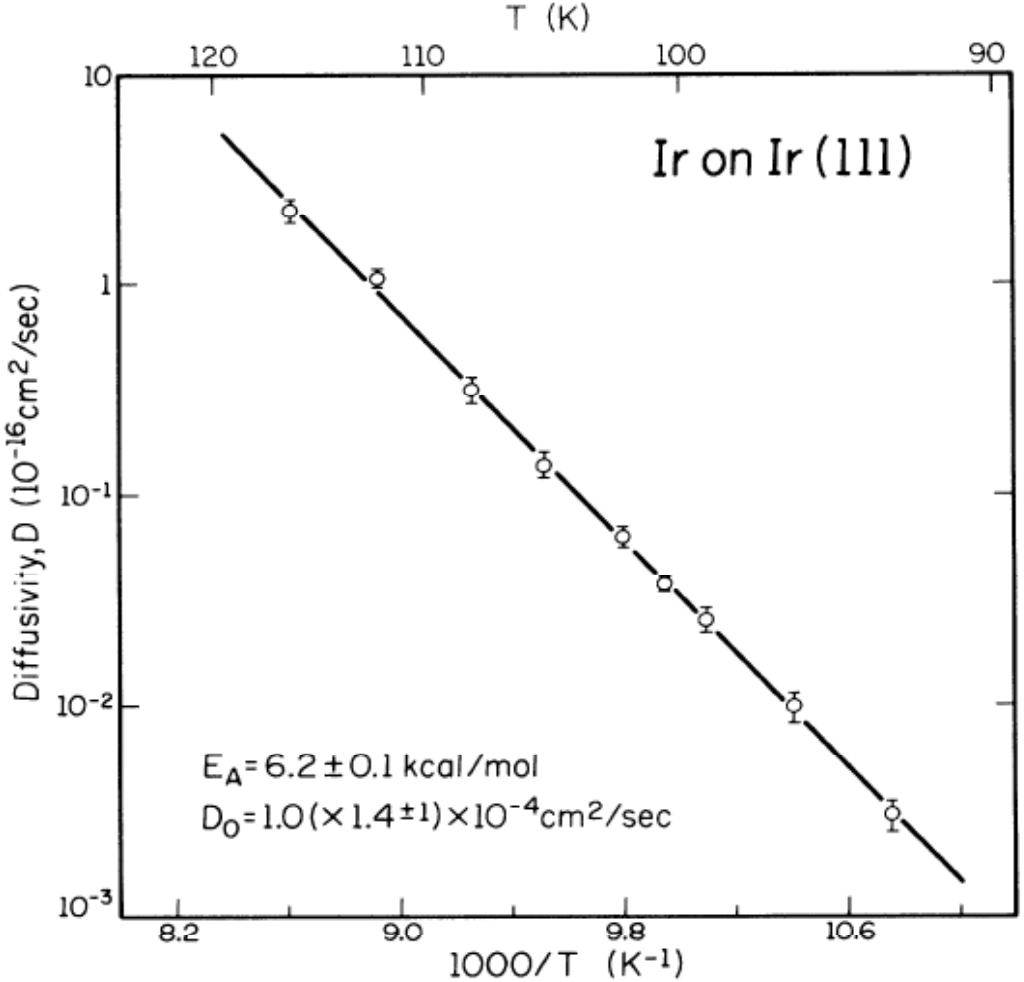


FIG. 6. Diffusivity of Ir adatoms on Ir(111), derived from mean-square displacement of a single atom at different temperatures.

S.C. Wang, G. Ehrlich, Phys. Rev. Lett. 62 (1989) 2297

Fig. 6.24

Interaction Between Nucleation and Growth

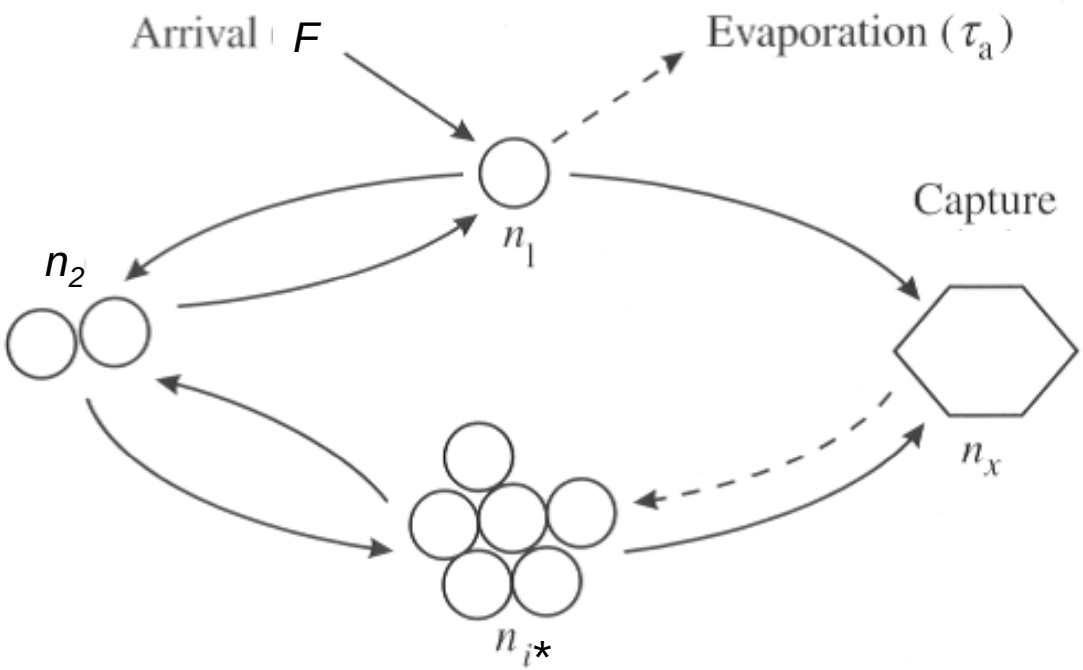
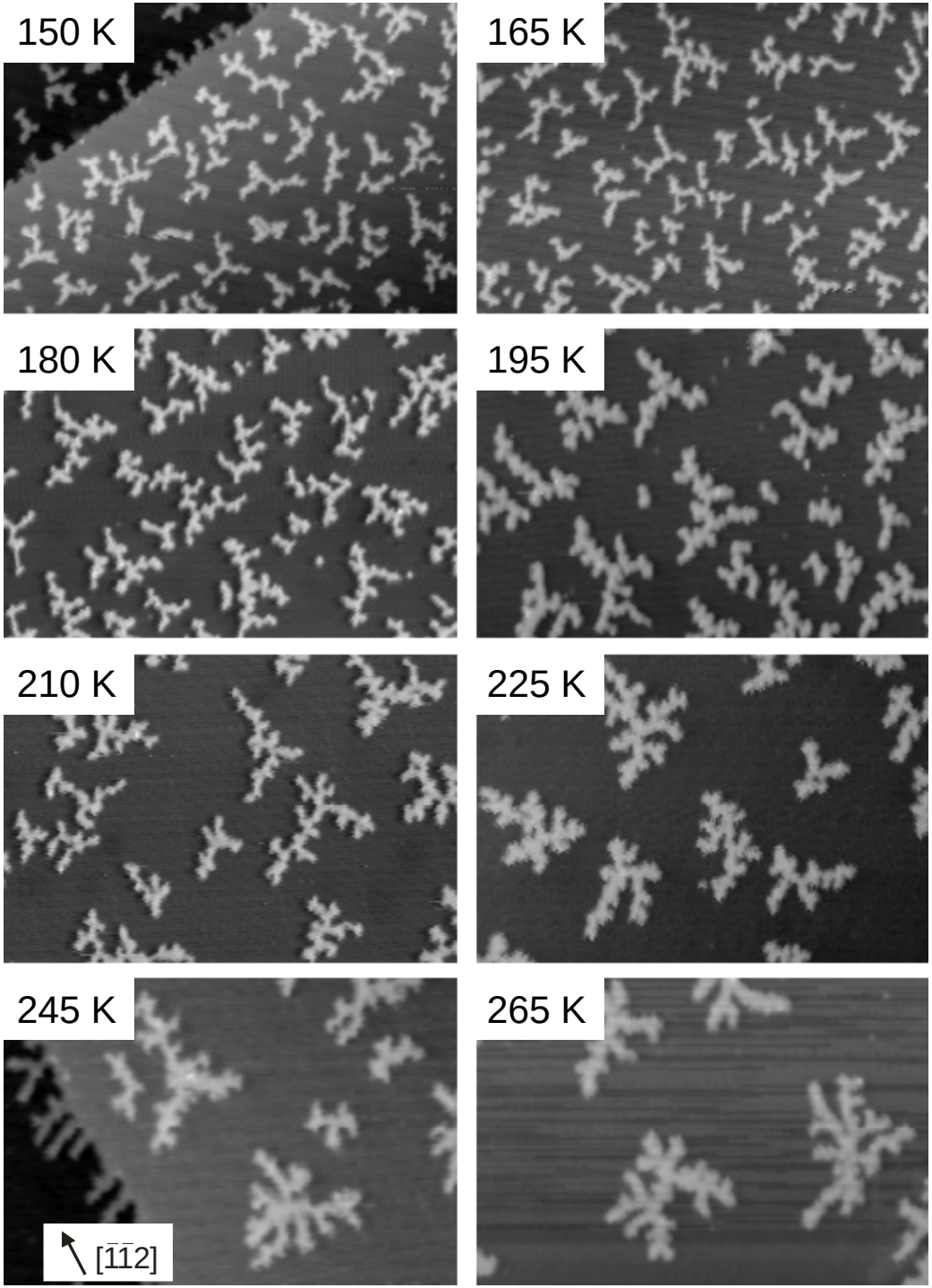


Figure 5.5. Schematic illustration of the interaction between nucleation and growth stages. The adatom density n_1 determines the critical cluster density n_i^*; however, n_1 is itself determined by the arrival rate F in conjunction with the various loss processes which have characteristic times as described in the text (Venables 1987).

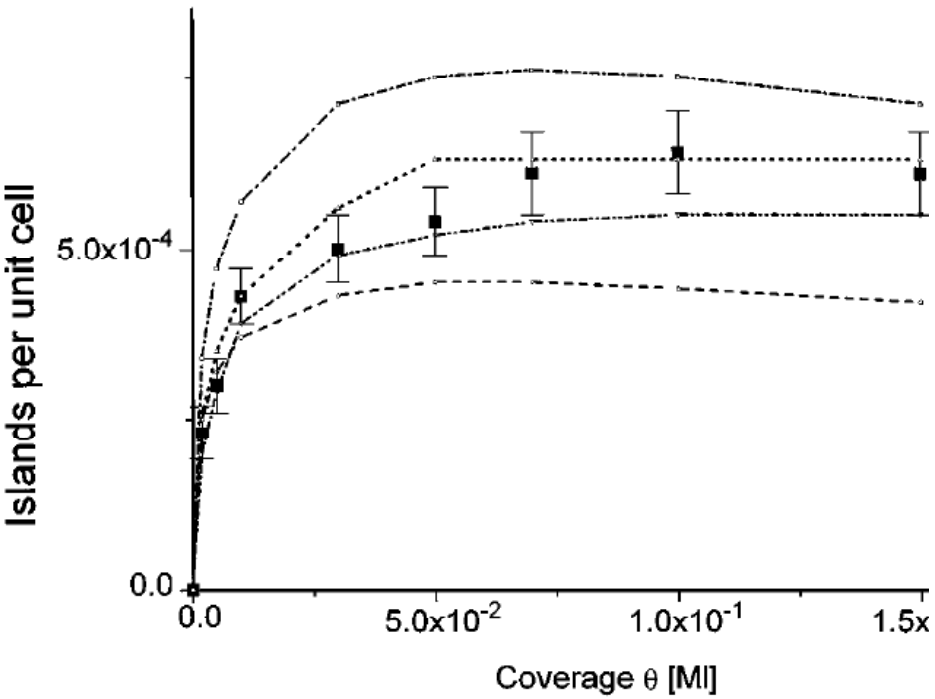
Fig. 6.25



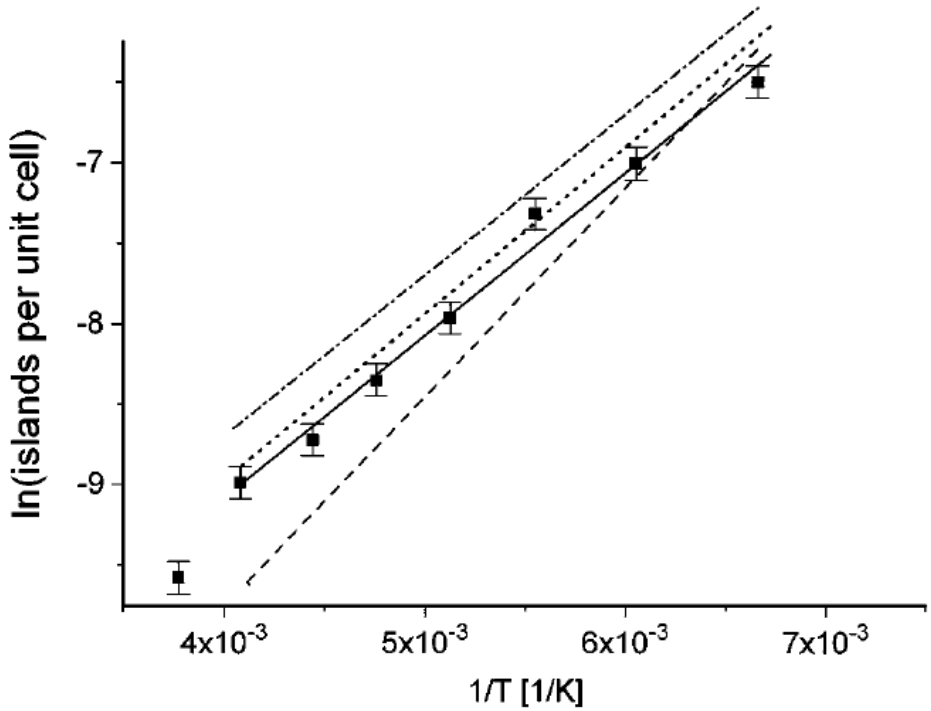
Pt Islands on Pt(111)

Fig. 6.26

Island Density as a Function of θ and T for Pt Islands on Pt(111)



island density as a function of coverate at 180 K



island density at coverage 0.1Ml
linear regression to STM data:
E_a = 0.26 eV

Fig. 6.27

M. Bott et al. PRL 76 (1996) 1304

Step Edge - or Ehrlich-Schwoebel Barrier

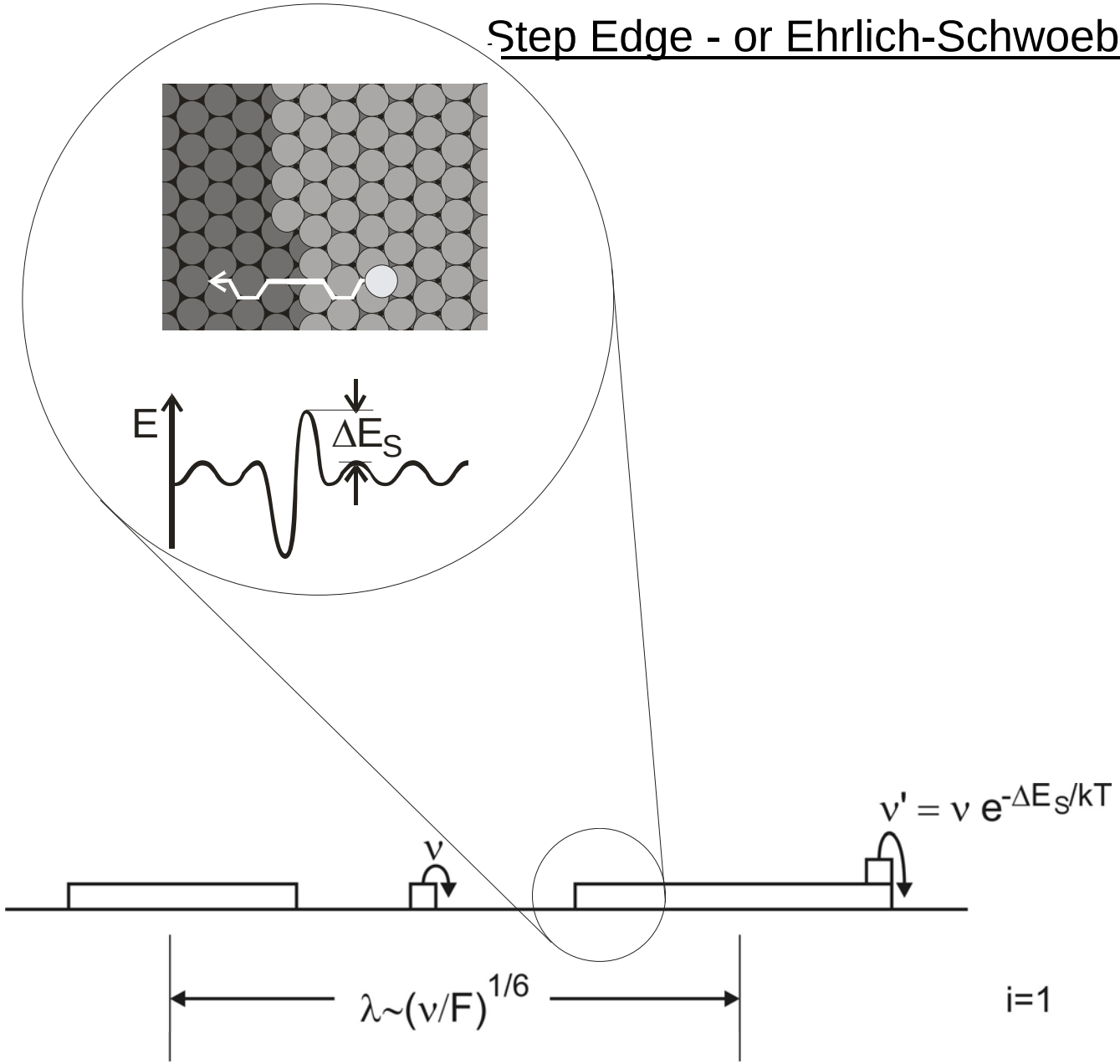
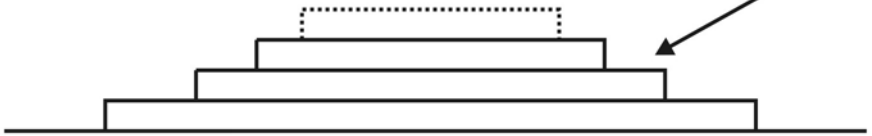


Fig.6.28

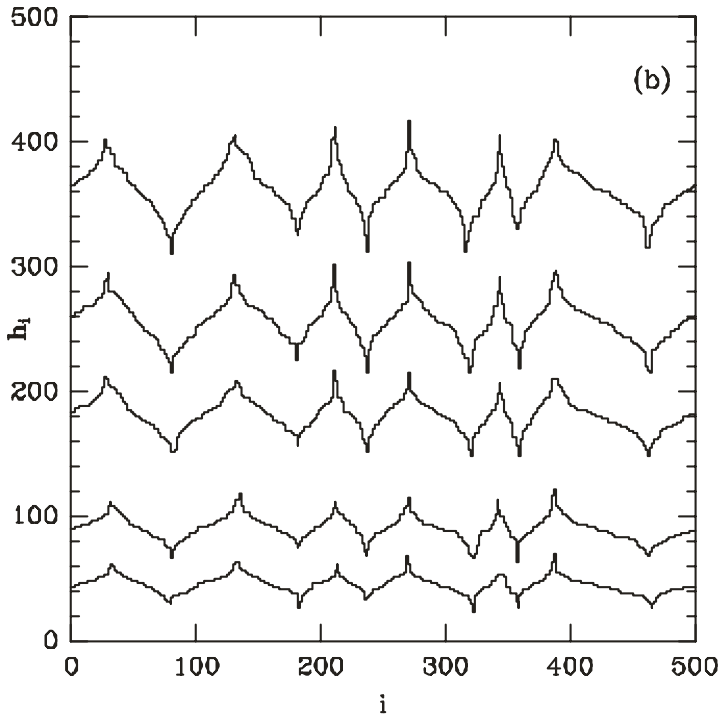
The Zeno Model

vertical: $\nu' = 0$ $(\nu' << \nu)$

$\partial\theta_n/\partial t = F(\theta_{n-1} - \theta_n)$



1D MC simulation



analytic solution:

$\sigma = \bar{h}^{0.5}$

λ = const.

shape

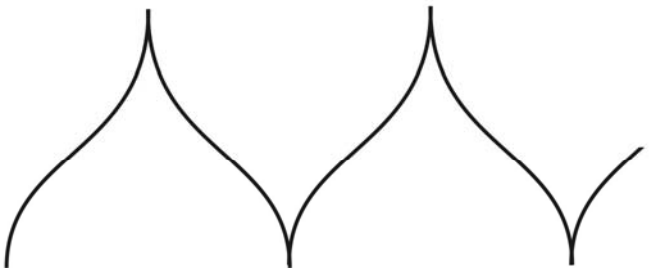
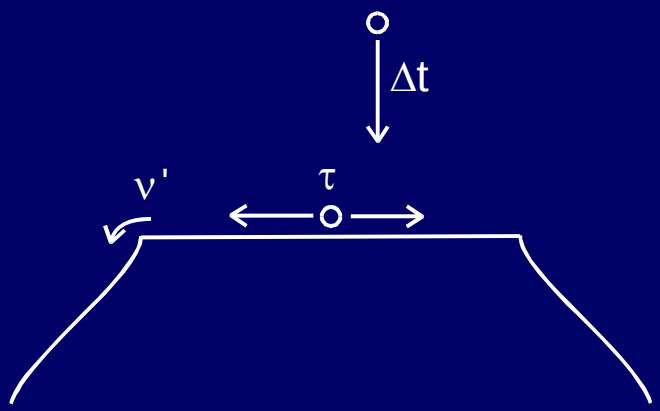
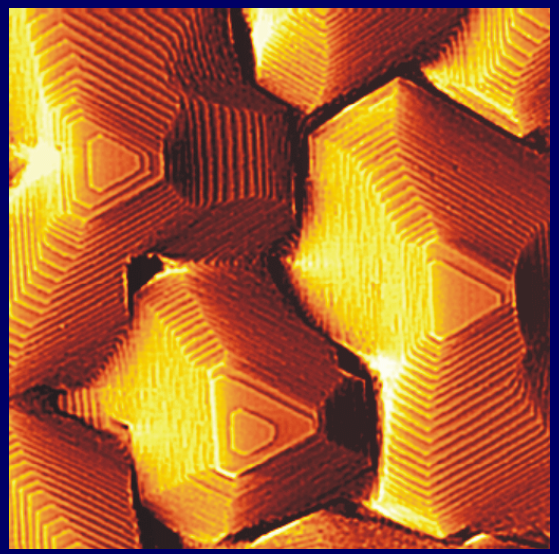


Fig. 6.29

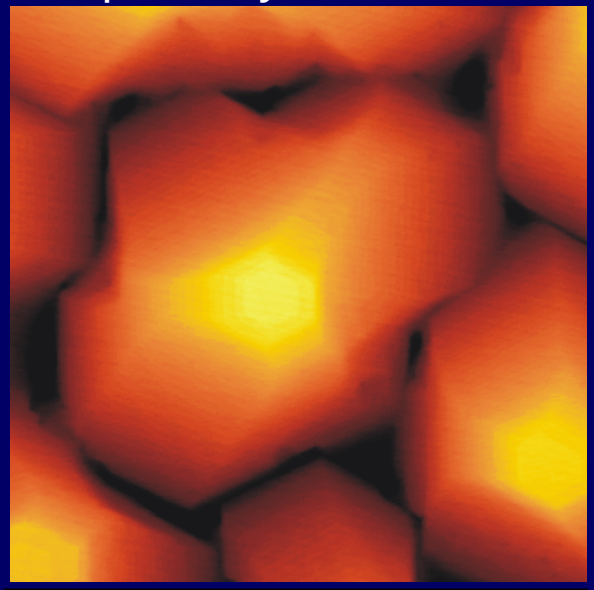
T. Michely, J. Krug, *Islands, Mound and Atoms,* Springer 2004

Nucleation on Top Terrace and Mound Profile for Finite Barriers





shape analysis:



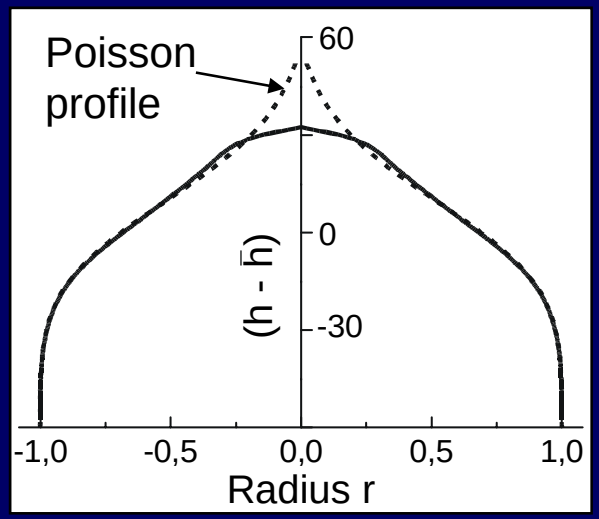


Fig. 6.30

Reading Atomistic Parameters from the Morphology

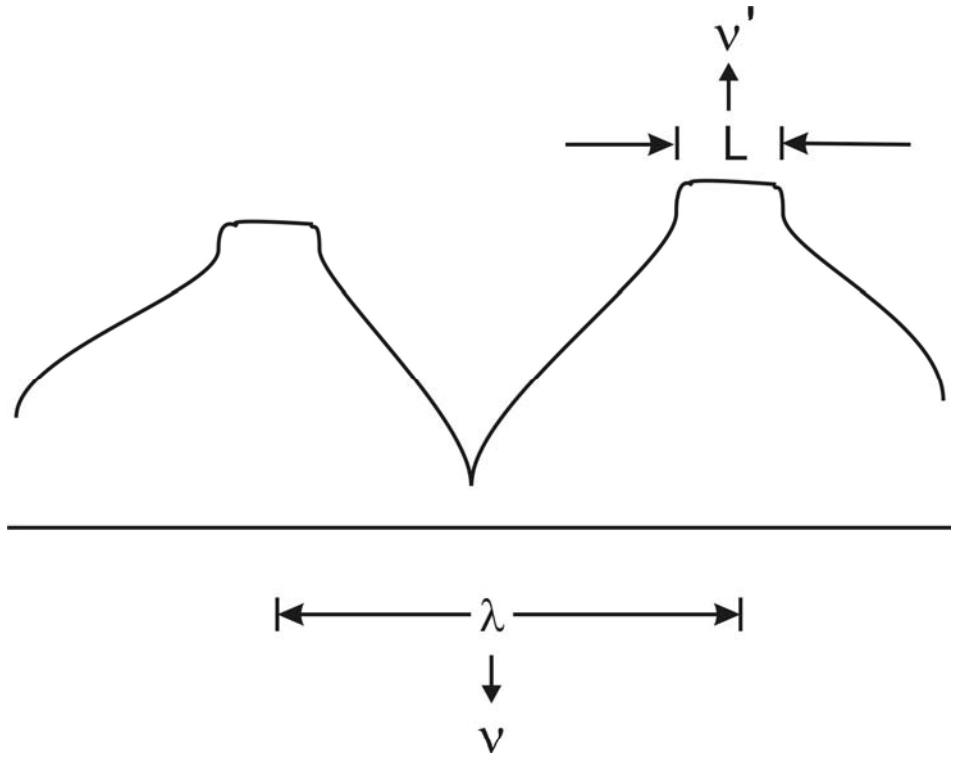
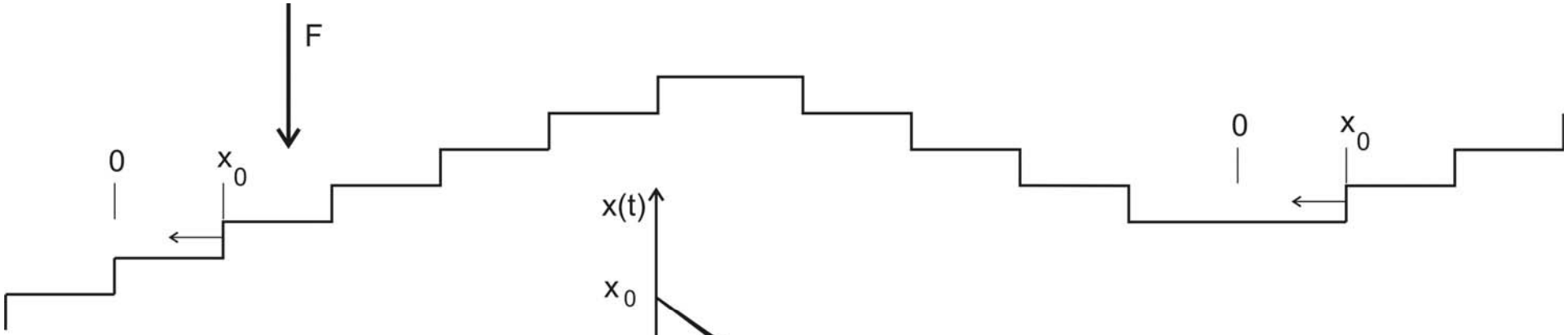


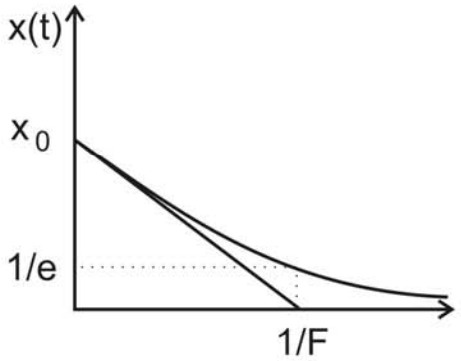
Fig. 6.31

Zeno-Effect



$\dot{x}(t) = -F \cdot x_0$

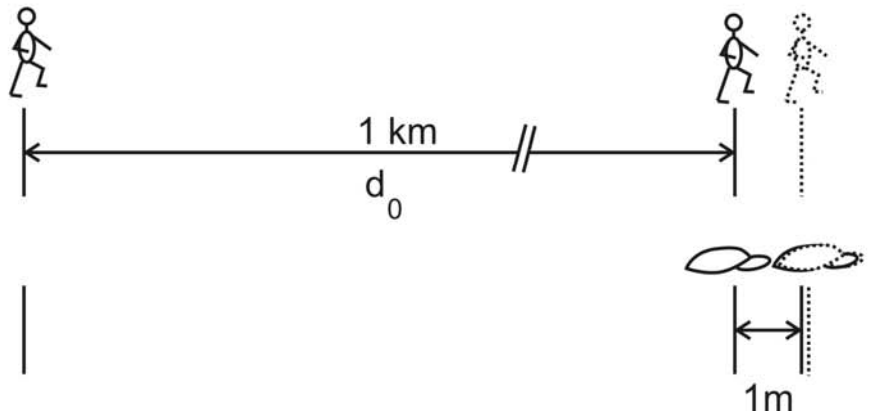
$x(t) = x_0 (1 - F \cdot t)$



$\dot{x}(t) = -F \cdot x \; ; \; x(0) = x_0$

$x(t) = x_0 e^{-F \cdot t}$

$$x\left(\frac{n}{F}\right) = x_0 e^{-n}$$



Zenon-Effekt

$$d(n) = d_0 10^{-3n}$$

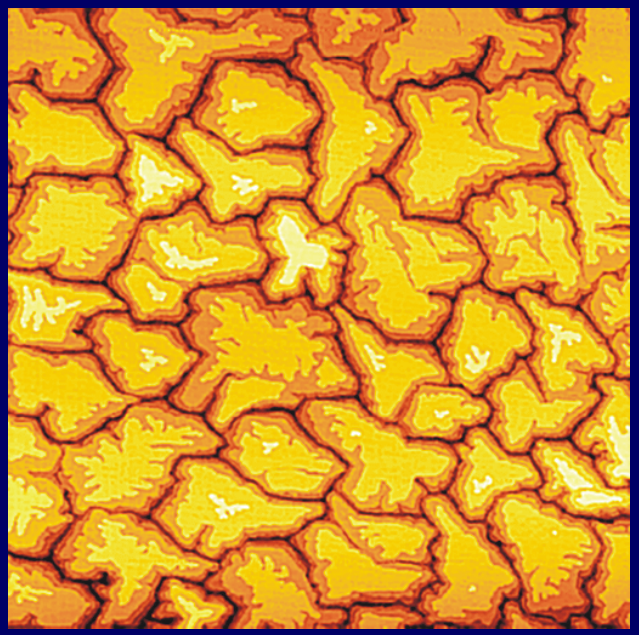
I. Ekanini & J. Villain, Sol. Stat. Com. 87 (1993) 105

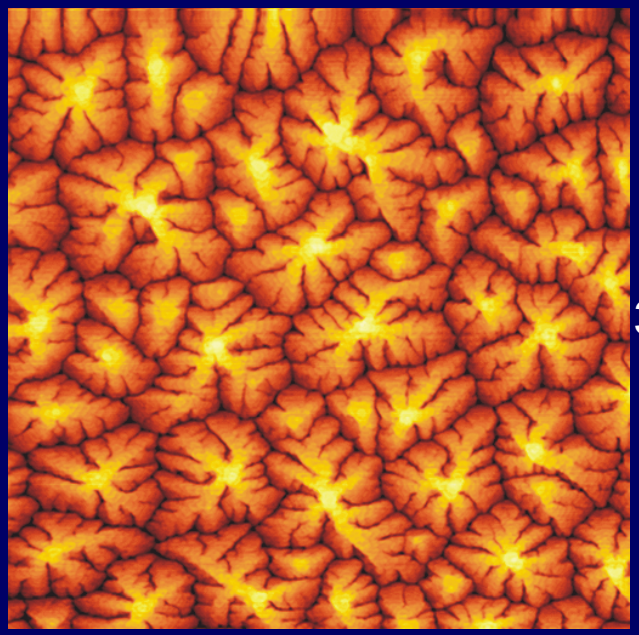
Fig. 6.32

Examples

10 ML
300 K

3000 Å



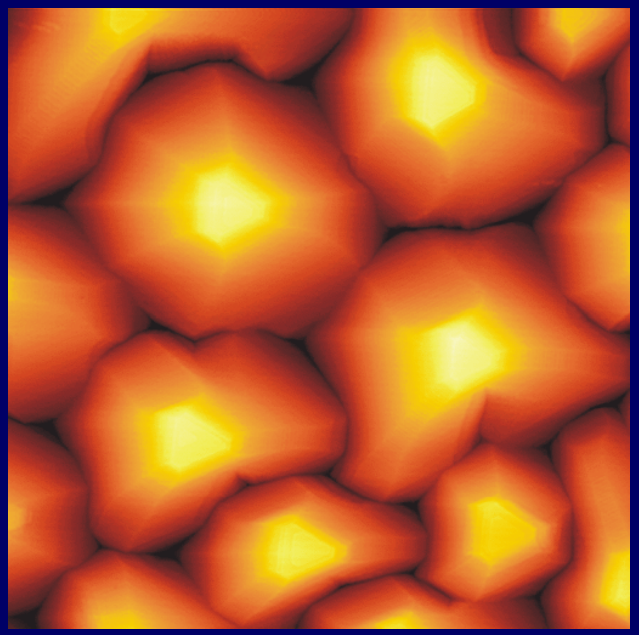


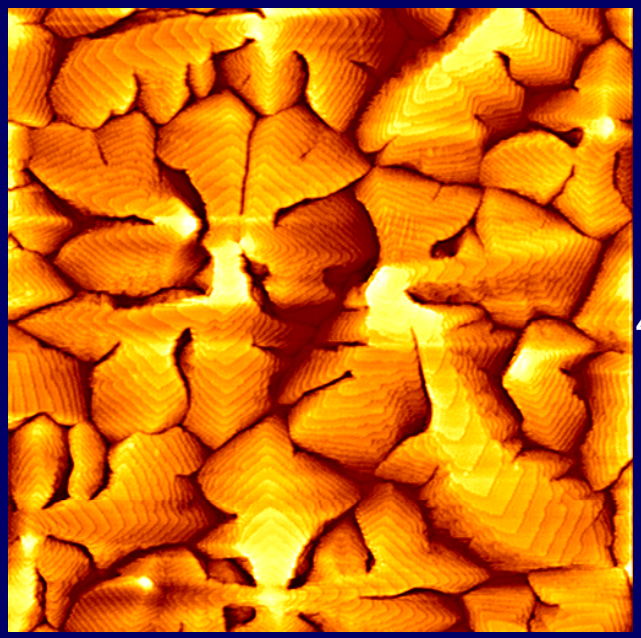
25 ML
420 K, CO

3200 Å

300 ML
440 K

3500 Å





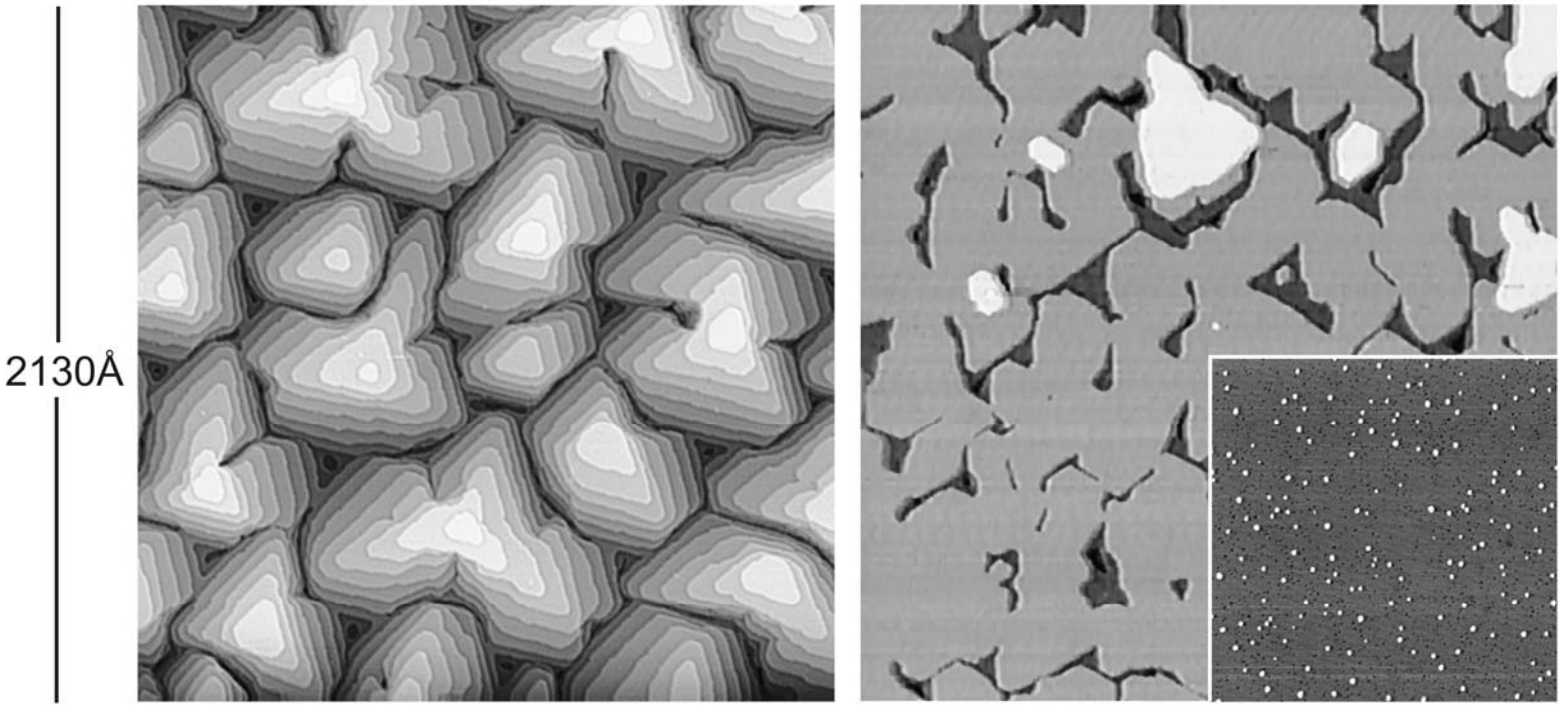
≈ 19 ML
pentacene on
amorphous
substrate

40000 Å

Fig. 6.33

Pulsed ion assisted homoepitaxy on Pt(111)

400 K, 5ML



no ion pulses

4 keV Ar^+ ion pulses in ML-timing, fluence each 0.003 ML

S. Esch, M. Breeman, M. Morgenstern, Th. Michely, G. Comsa, SS 365 (1996) 187;

Fig. 6.34