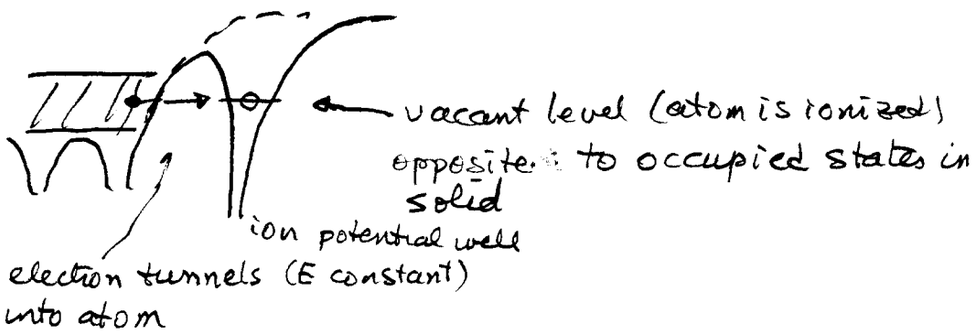
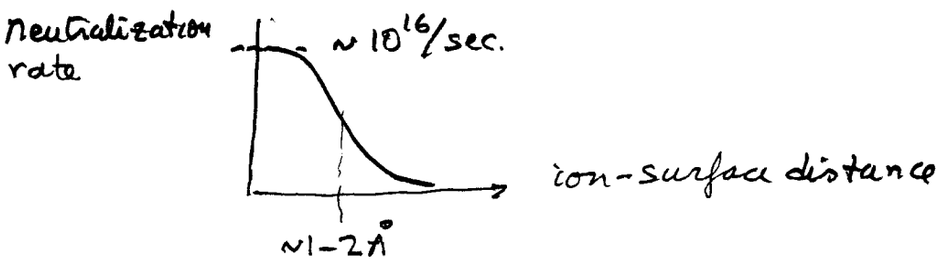
Election Transfer at Surfaces

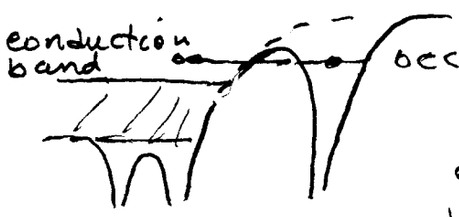
Resonant neutralization of + ion



Election tunnels through barrier

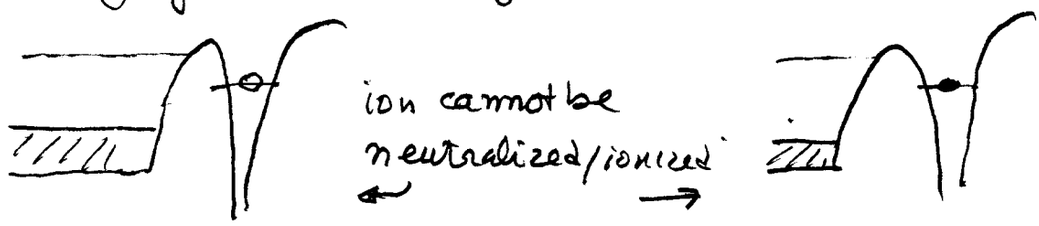


Resonant ionization of atoms or − ions

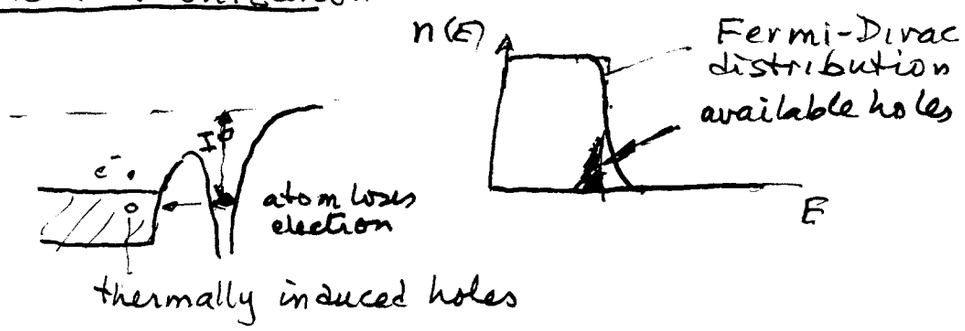


election tunnels to unoccupied but available states in the solid

Blocking of electron transfer in insulators



Thermal ionization



$$P_{ioniz} = A_+ e^{-(IP-\Phi)/kT}$$

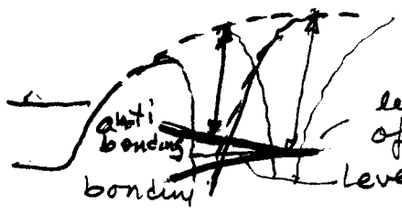
formation of negative ion by capturing electron in thermal tail

$$P = A_- e^{-(X-\Phi)/kT}$$

In both cases one gets $\exp(-\Delta E/kT)$ where ΔE is the difference in energy between the atomic state and the Fermi level

Effect of image interaction – Level shift

Neutral atom



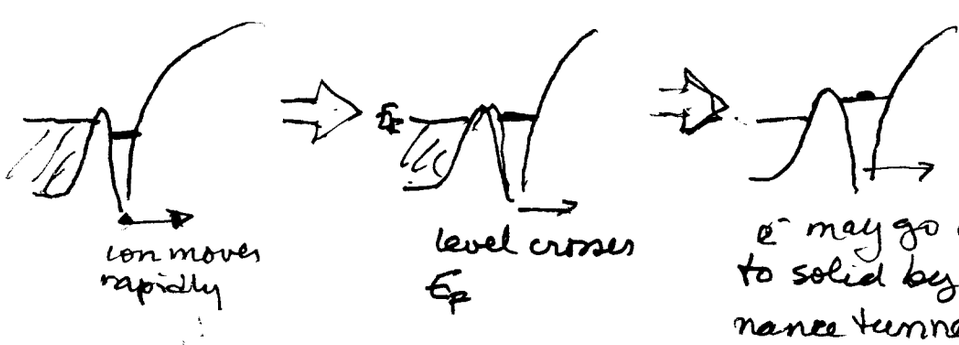
level shifts up because of screening from solid
Level split due to field

ionization potential decreases because vacuum level follows image interaction; Ionized electron is attracted to solid

Negative ion

extra e⁻ is attracted by image. Level sinks up to a few eV is possible.

Sputtering of negative ions

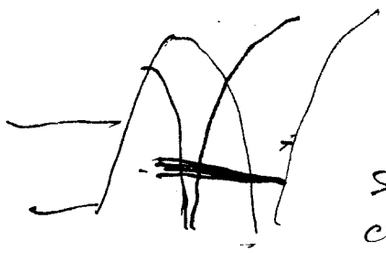


Survival depends on transit time near surface (on $v_\perp$ surface)

Broadening

$\Delta E = \frac{\hbar}{\tau}$ τ – lifetime of state (time to observe it)

(Heisenberg)



state broadens when atom gets close to surface since when E is measured by removing electron, there is a fast re-neutralization from the solid