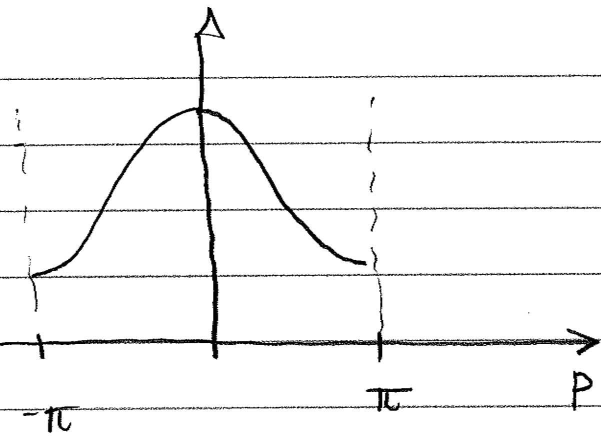
DOS-1

$$E_p = A + 2B\cos p$$

Use p so we Don't confuse this with previous label of destination



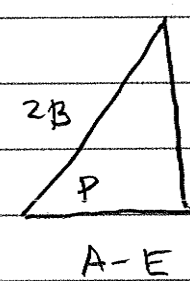
$$g(E) = \int dp\, \delta(E - E_p)$$

$$= \int dp\, \delta(E - A - 2B\cos p)$$

$$\delta[f(x)] = 1/|f'(x)|\, \delta(x - x_0)$$

x_0: locations where $f(x) = 0$

derivative is $2B\sin p$



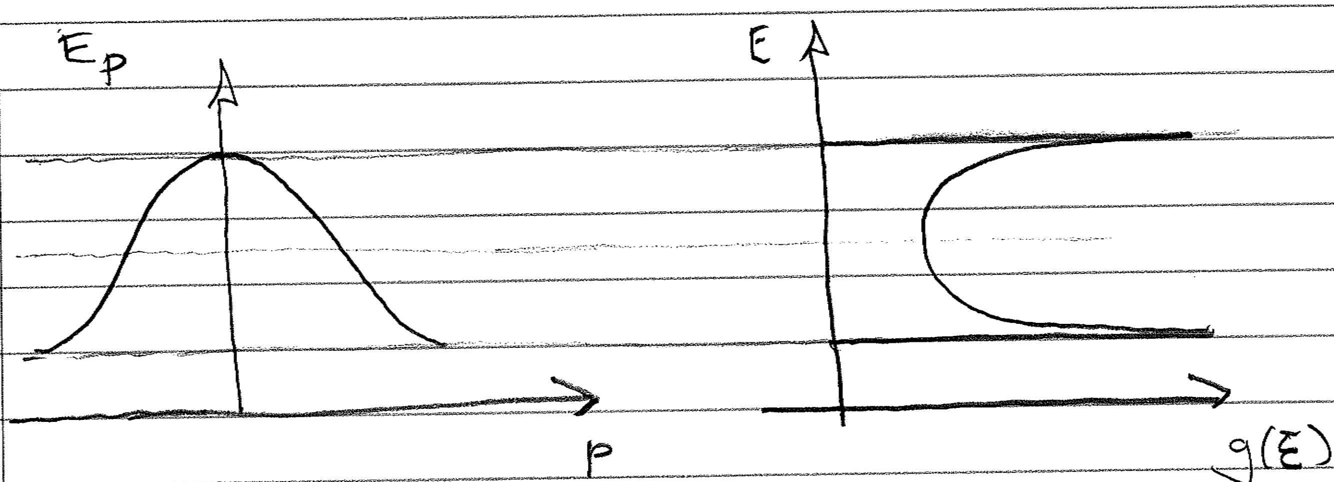
$$\cos p = \frac{A - E}{2B}$$

$$\sin p = \frac{\sqrt{4B^2 - (A-E)^2}}{2B}$$

$$g(E) = \left[4B^2 - (A-E)^2\right]^{-1/2}$$

DOS-2

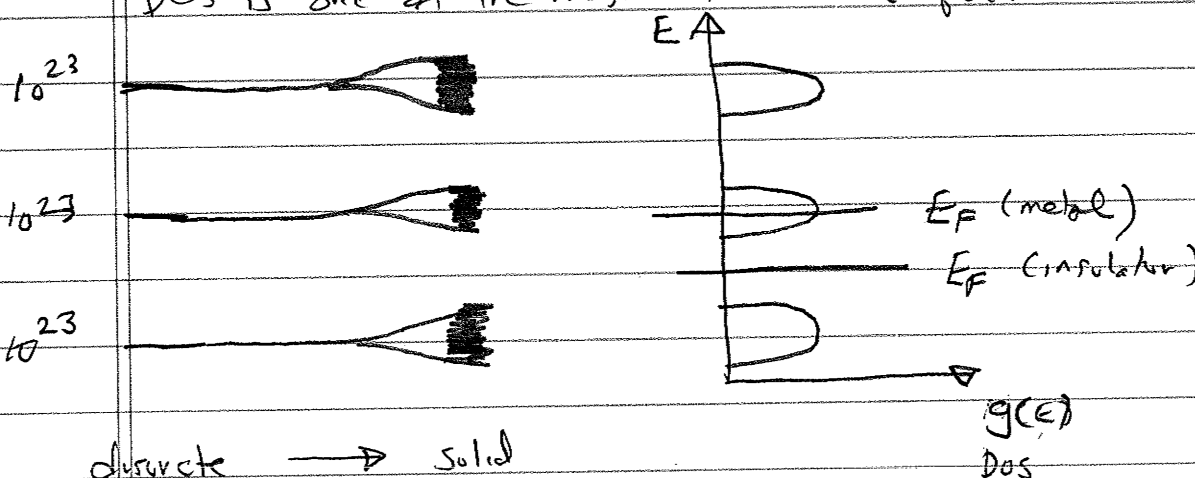
$E = A \pm 2B$ $g(E)$ is huge!



Q: units of $g(E)$ are?
A: $1/E$

DOS is one of the most fundamental quantities in CMP.

(1)



discrete atomic levels → solid (many atoms) Energy bands

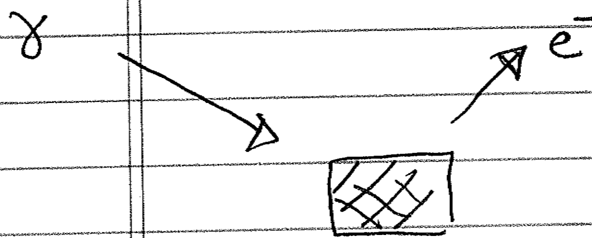
(2) Magnetism criterion $U g(E_F) > 1$

Superconducting T_c $T_c = \omega_{ph} e^{-1/\lambda g(E_F)}$

etc

How is DOS Measured?

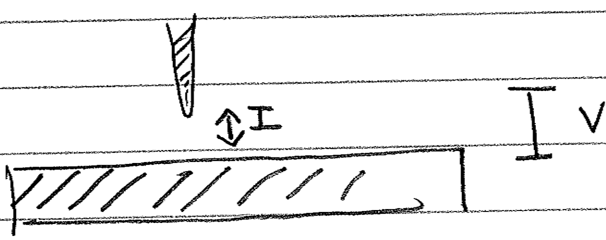
① FADLEY Photoemission Spectroscopy ALS @ LBL
SSRL @ Stanford



ARPES
↑
angle resolved

electron states of given energy and momentum.

② Chiang Scanning tunneling Microscopy



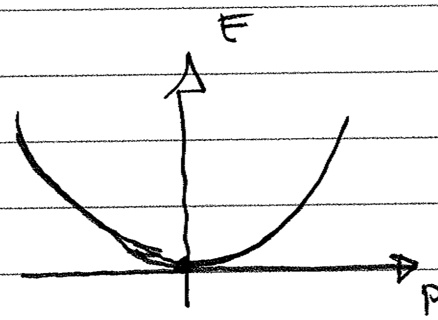
A local probe — sensitive to atomic positions on surface.

Free particles in $d=1$

$$E_p = p^2/2m \qquad p = \sqrt{2mE}$$

$$g(E) = \int \delta(E - p^2/2m)\, dp$$

$$= \frac{1}{p/m} = \sqrt{\frac{m}{2}}\, E^{-1/2}$$



large dos near $E=0$
where band is flat.

In 3d

$$g(E) = \int \delta(E - p^2/2m)\, 4\pi p^2 dp$$

$$= \frac{1}{p/m}\, 4\pi p^2$$

$$= 4\pi m \sqrt{2mE}$$

$g(E) \sim E^{1/2}$ a widely used CMP result