\[ E_p = A + 2B \cos \phi \]

Use \( p \) so we don't confuse this with previous label of destination.

\[ g(E) = \int dp \, \delta(E - E_p) \]
\[ = \int dp \, \delta(E - A - 2B \cos \phi) \]

\[ \delta[f(x)] = \frac{1}{|f'(x)|} \delta(x - x_0) \]

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

Derivative w.r.t \( 2B \sin \phi \)

\[ \cos \phi = \frac{A - E}{2B} \]

\[ \sin \phi = \sqrt{4B^2 - (A - E)^2} \]

\[ g(E) = \left[ 4B^2 - (A - E)^2 \right]^{-1/2} \]
E = A \pm 2B \quad g(E) \text{ is huge!}

Q: Units of g(E) are?
A: \dfrac{1}{E}

DOS is one of the most fundamental quantities in CMD.

10^3

10^2

10

Discrete -> Solid
atomic levels (many along)
Energy bands

2. Magnetism criterion \quad U g(E_F) > 1

Superconducting \quad T_c \quad T_c = \frac{\omega_p}{\phi_0} \frac{1}{\lambda g(E_F)}
How is DAS measured?

1. FADLEY Photoemission ALS e LBL Spectroscopy SSRL e Stanford

γ → e⁻ ARCES
angle resolved
# electron state of given energy and momentum.

2. Chiang Scanning tunneling microscopy

A local probe sensitive to atomic positions on surface
Free particles in $d = 1$

$$E_p = \frac{p^2}{2m}, \quad p = \sqrt{2mE}$$

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

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

Large DOS near $E = 0$
where band is flat.

In 3d

$$g(E) = \int \delta(E - \frac{p^2}{2m}) \, \frac{4\pi \rho^2}{p} \, dp$$

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

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

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