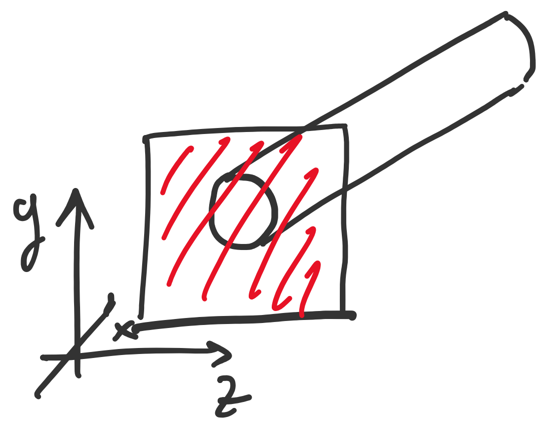
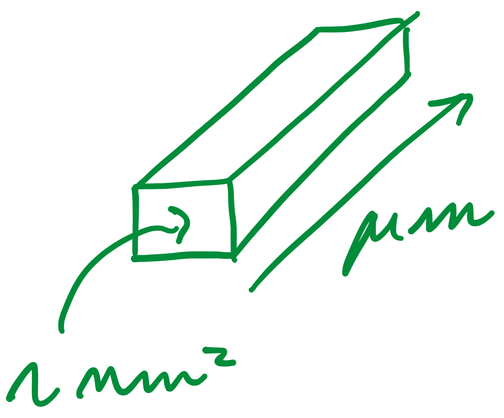
2D CONFINEMENT

Friday, 22 November 2019 09:06





$$\psi_{k_x,i} = \frac{e^{j k_x x}}{\sqrt{L_x}} \chi_i(y,z)$$

confinamento è sul piano y-z

$$\boxed{E_{i,k_x} = \varepsilon_i(x) + \frac{\hbar^2 k_x^2}{2 m_x}}$$

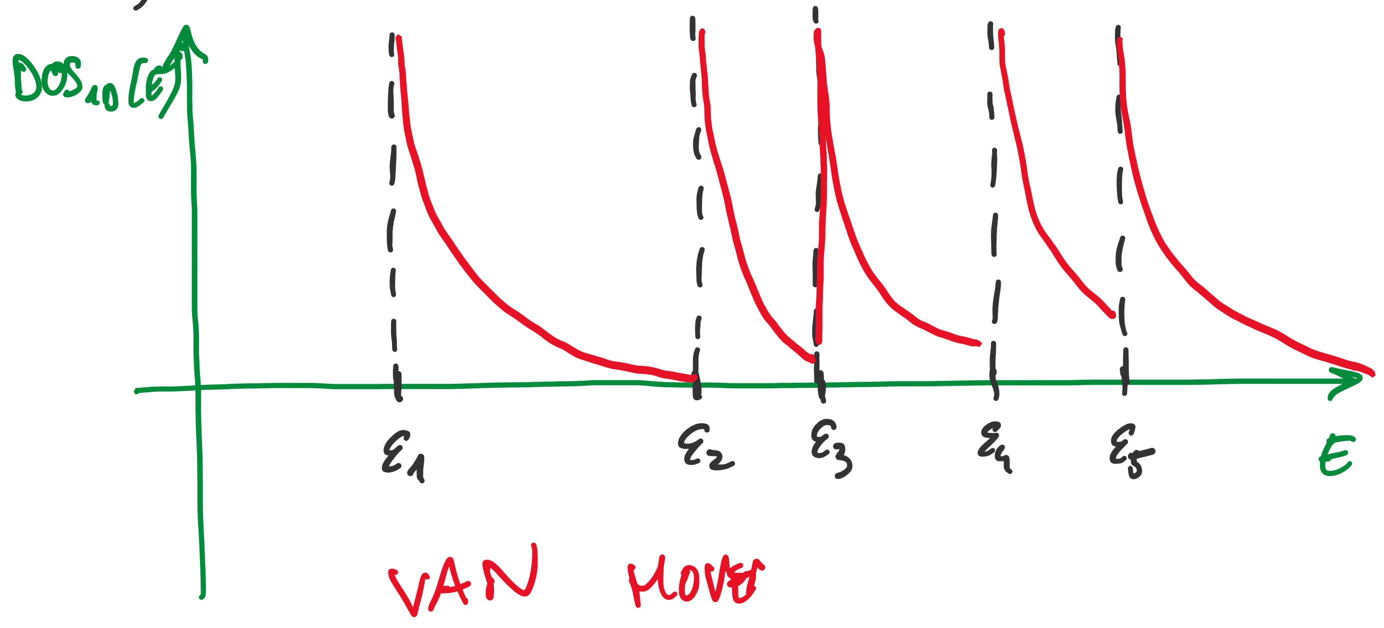
$$n(x,y,z) = \sum_i |\chi_i|^2 \underbrace{\sum_{k_x} \frac{f(E_{i},k_x)}{L_x}}_{\alpha_i} = \sum_i |\chi_i|^2 \alpha_i$$

$$\alpha_i = \sum_{k_x} \frac{f(E_i,k_x)}{L_x} \simeq \frac{2\cancel{L_x}}{2\pi} \int_{-\infty}^{+\infty} \frac{f(E_i,k_x)}{\cancel{L_x}} dk_x = \frac{2}{\pi}\int_0^{+\infty} f(E_i,k_x)\, dk_x$$

$$k_x = \frac{\sqrt{2m_x(E-\varepsilon_i)}}{\hbar} \Rightarrow dk_x = \frac{1}{\hbar}\frac{\sqrt{2m_x}}{2\sqrt{E-\varepsilon_i}} dE$$

$$\alpha_i = \int_{\varepsilon_i}^{+\infty} \underbrace{\frac{\sqrt{2m_x}}{\pi\hbar} \frac{1}{\sqrt{E-\varepsilon_i}}}_{DOS_{1D}} f(E-\varepsilon_i)\, dE$$

$$\rho = \int DOS(E)\, f(E)\, dE$$



INTEGRALI DI FERMI-DIRAC

$$F_j(x) = \frac{1}{\Gamma(j+1)} \int_0^{+\infty} \frac{t^j}{e^{t-x}+1} dt$$

arxiv

"NOTES ON FERMI-DIRAC INTEGRALS"

R. KIM & M. LUNDSTROM

$$\frac{\partial F_j}{\partial x} = F_{j-1}$$

$$F_{-\frac{1}{2}}(y) = \int_0^{+\infty} \frac{1}{\sqrt{x}} \frac{1}{1+\exp(x-y)} dy$$

$$n_{1D} = \frac{1}{\pi}\left(\frac{2 m_x k_B T}{\hbar^2}\right)^{1/2} \sum_i |\chi_i|^2 F_{-1/2}\left(\frac{E_F-\varepsilon_i}{k_B T}\right)$$

3D confinement

$$n = \sum_i |\psi_i|^2 \frac{1}{1+\exp\left(\frac{\varepsilon_i - E_F}{k_B T}\right)}$$