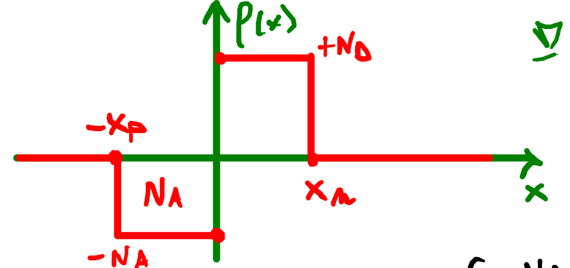


$\nabla \cdot (\varepsilon \nabla \phi) = -q\rho$

$$\begin{cases} \frac{\partial}{\partial x}\varepsilon\frac{\partial \phi}{\partial x} = -q\rho \\ E(-x_p)=E(x_n)=0 \end{cases} \qquad \rho(x): \begin{cases} -N_A & -x_p \le x < 0 \\ +N_D & 0 \le x \le x_n \end{cases}$$

ε cost $\quad \varepsilon = \bar{\varepsilon} \quad \forall \underline{x}$

$E \triangleq$ Campo elettrico $[V/m]$

$\varepsilon \triangleq$ costante dielettrica $= \varepsilon_r \varepsilon_0$

$\phi \triangleq$ potenziale elettrico

Integro in x

$$\varepsilon\frac{\partial \phi}{\partial x} = -q\rho x + C \qquad E = -\frac{\partial \phi}{\partial x}$$

$$E(x) = +q\frac{\rho}{\varepsilon}x - C$$

$$\begin{cases} E(x_n) = E(-x_p) = 0 \\ \rho(x_n) = N_d;\ \rho(-x_p) = -N_A \end{cases}$$

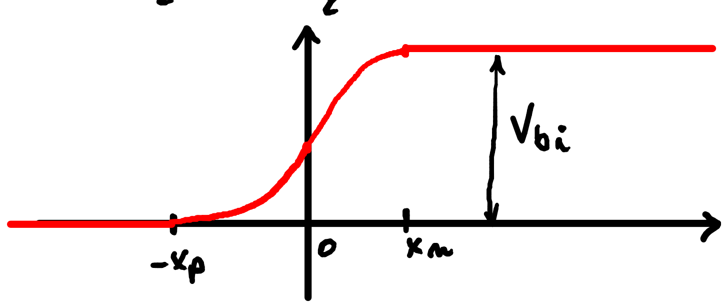
$$q\frac{N_d x_n}{\varepsilon} = C \ ; \quad C' = q\frac{N_A}{\varepsilon}x_p$$

$$\frac{d\phi}{dx}: \begin{cases} q\frac{N_A}{\varepsilon}(x+x_p) & -x_p \le x < 0 \\ -q\frac{N_D}{\varepsilon}(x-x_n) & 0 \le x \le x_n \end{cases}$$

$$\phi: \begin{cases} \frac{qN_A}{2\varepsilon}(x+x_p)^2 + C''' & -x_p \le x < 0 \\ -\frac{qN_D}{2\varepsilon}(x-x_n)^2 + C^{IV} & 0 \le x \le x_n \end{cases}$$

Siccome $E(x=0^-) = E(x=0^+)$

$$q\frac{N_A}{\varepsilon}x_p = q\frac{N_D x_n}{\varepsilon} \Rightarrow N_A x_p = N_D x_n$$



$$q\frac{N_A}{2\varepsilon}x_p^2 = -q\frac{N_D}{2\varepsilon}x_n^2 + C^{IV}$$

$$\begin{cases} \frac{qN_A}{2\varepsilon}x_p^2 + q\frac{N_D}{2\varepsilon}x_n^2 = \underline{\underline{V_{bi}}} \\ N_A x_p = N_D x_n \end{cases}$$

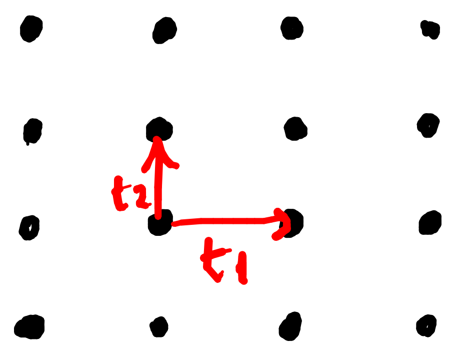
$$V_{bi} = \frac{q}{2\varepsilon}\left(N_A x_p^2 + \frac{N_D^2 x_n^2}{N_D}\right) = \frac{q}{2\varepsilon}\left(N_A x_p^2 + \frac{N_A^2 x_p^2}{N_D}\right) =$$

$$= \frac{q}{2\varepsilon}N_A\left(1 + \frac{N_A}{N_D}\right)x_p^2$$

$$x_p = \sqrt{\frac{2\varepsilon N_D V_{bi}}{qN_A(N_D+N_A)}} \ ; \quad x_n = \sqrt{\frac{2\varepsilon N_A V_{bi}}{qN_D(N_A+N_D)}}$$

Reticoli di Bravais

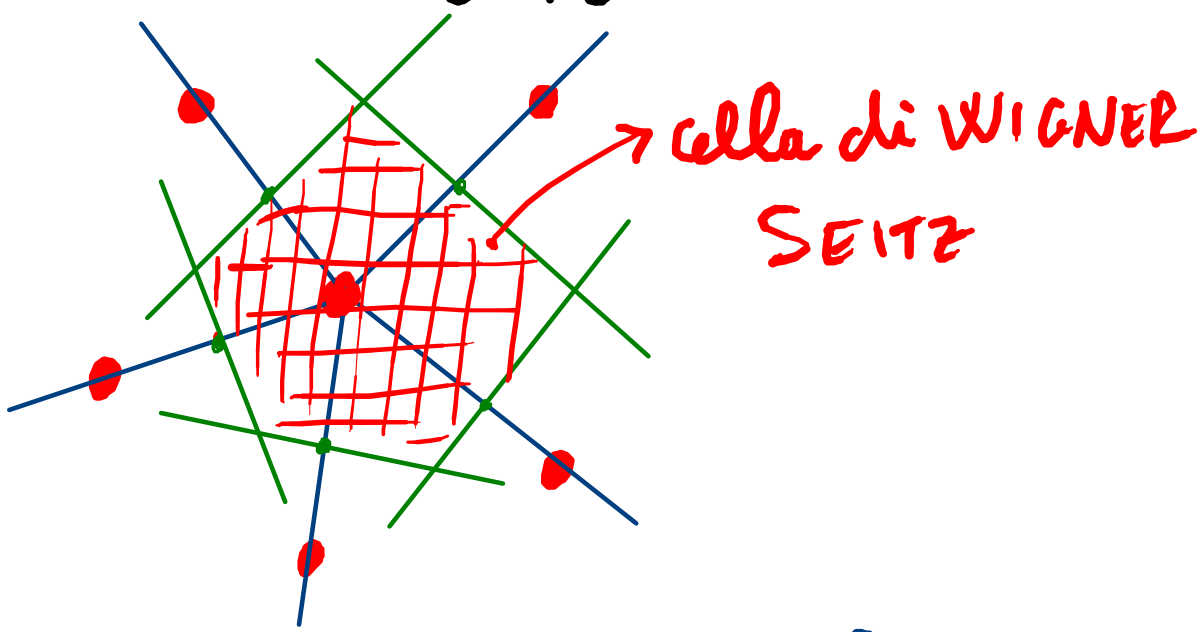
Distribuzione periodica e regolare di punti nello spazio



$$\underline{t_n} = n_1\underline{t_1} + n_2\underline{t_2} + n_3\underline{t_3}$$

$$\Omega = \underline{t_1}\cdot(\underline{t_2}\times\underline{t_3})$$

WIGNER-SEITZ



$\underline{t_i}$

$$\underline{g_i}\cdot\underline{t_i} = 2\pi\,\delta_{ij}$$

$$\delta_{ij} : \begin{cases} 1 & i = j \\ 0 & i \neq j \end{cases}$$

$$\underline{g_1} = \frac{2\pi}{\Omega}\,\underline{t_2}\times\underline{t_3} \; ; \; \underline{g_2} = \frac{2\pi}{\Omega}\,\underline{t_3}\times\underline{t_1}$$

$$\underline{g_3} = \frac{2\pi}{\Omega}\,\underline{t_1}\times\underline{t_2} \qquad \Omega = \underline{t_1}\cdot(\underline{t_2}\times\underline{t_3})$$

$$\underline{g_m} = m_1\underline{g_1} + m_2\underline{g_2} + m_3\underline{g_3}$$

$$\underline{g_m}\cdot\underline{t_n} = 2\pi\cdot i \; : \; \underline{i \text{ intero}}$$