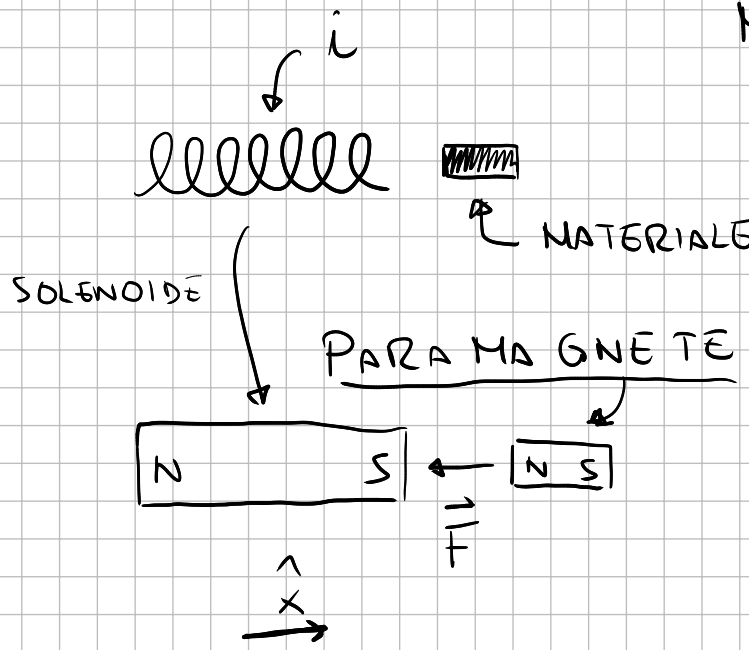
MAGNETISMO NELLA MATERIA



$$\vec{B}_0 = \mu_0 n i \hat{x}$$

$$\vec{B} = K_m \vec{B}_0 = K_m \mu_0 n i \hat{x} = \mu n i$$

K_m: PERMEABILITÀ MAGNETICA RELATIVA

$\mu = K_m \mu_0$: PERMEABILITÀ MAGNETICA

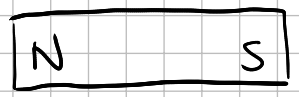
$$\underbrace{\vec{B} - \vec{B}_0}_{\text{CAMPO DOVUTO AL MATERIALE}} = (K_m - 1)\vec{B}_0 \equiv \chi_m \vec{B}_0$$

χ_m: SUSCETTIVITÀ MAGNETICA

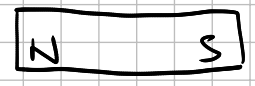
$$\boxed{\chi_m = K_m - 1}$$

$$\vec{B} = \vec{B}_0 + \chi_m \vec{B}_0$$

SOLENOIDE — MATERIALE



PARA



DIA

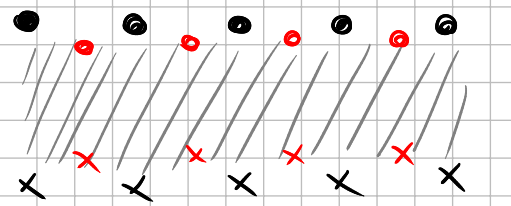
il materiale si magnetizza → acquista un momento di dipolo magnetico $\vec{m}$

⇒ si definisce $\vec{M} = \frac{\vec{m}}{\tau}$ MAGNETIZZAZIONE

τ → VOLUME DELL'OGGETTO

PARAMAGNETI

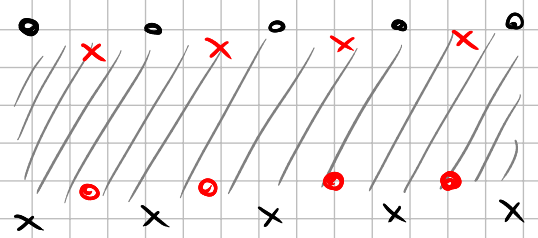
$K_m > 1$, $\chi_m > 0$



$\chi_m \sim 10^{-4} \div 10^{-5}$

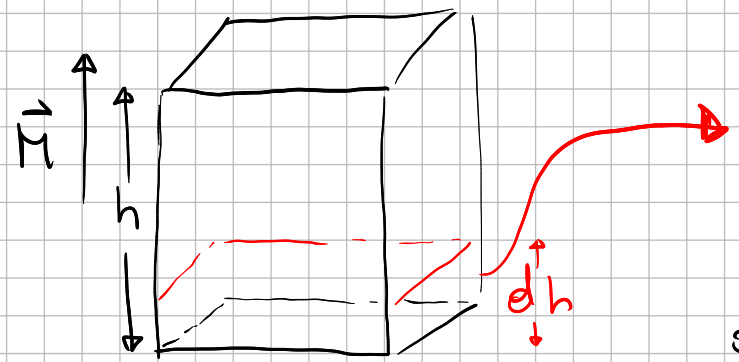
DIAMAGNETI

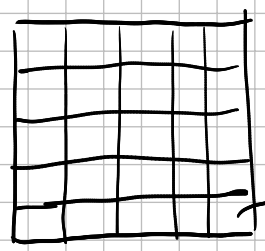
$K_m < 1$, $\chi_m < 0$



$\chi_m \sim -10^{-5}$

MAGNETIZZAZIONE





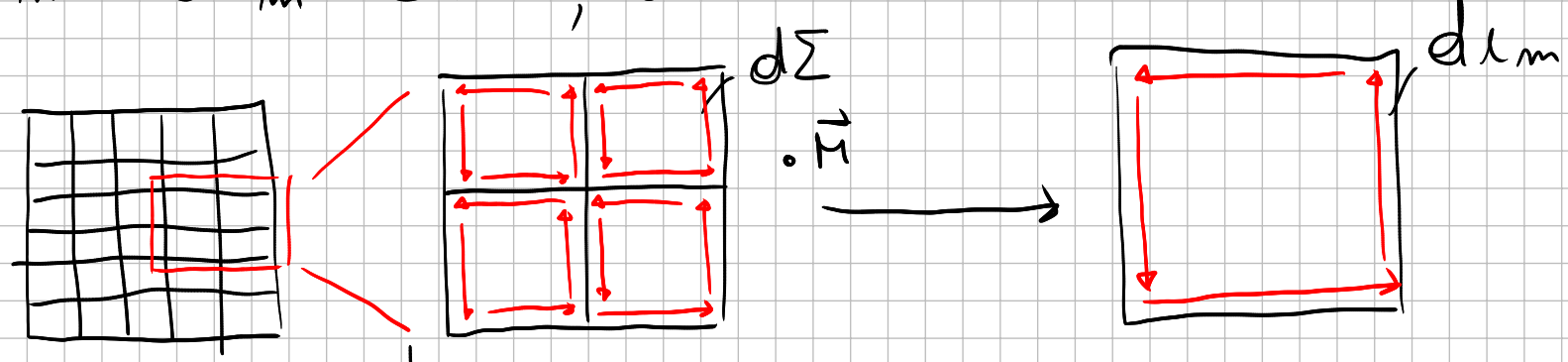
$\vec{M}$ costante

$d\Sigma$ con normale $\hat{n} \parallel \vec{M}$

ogni porzione ha momento di dipolo $d\vec{m}$

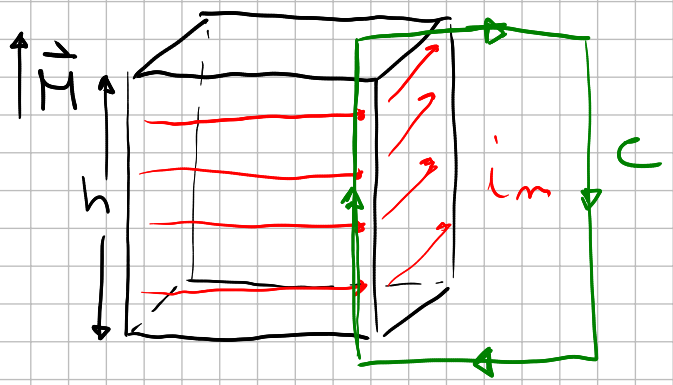
$$\boxed{d\vec{m}} = \vec{M}\, d\tau = \vec{M}\, dh\, d\Sigma = \boxed{M\, dh\, d\Sigma\, \hat{n}} \qquad \left[\boxed{\vec{m}} = \boxed{i\, \Sigma\, \hat{n}}\right] \Rightarrow$$

$$d\vec{m} = di_m\, d\Sigma\, \hat{n} \quad , \text{ dove } di_m = M\, dh$$



$$\Rightarrow \quad i_m = \int_0^h M\, dh = Mh$$ corrente di magnetizzazione

VETTORE $\vec{H}$



$$\oint_C \vec{M}\cdot d\vec{s} = \int_0^h M\,dh = Mh = i_m$$

LEGGE DI AMPERE PER $\vec{M}$

$\rightarrow$ N di spire concatenate

$$\oint_C \vec{B}\cdot d\vec{s} = \mu_0 N i + \mu_0 i_m = \mu_0 N i + \mu_0 \oint_C \vec{M}\cdot d\vec{s} \Rightarrow$$

$i \rightarrow$ corrente di conduzione

$$\oint_C (\vec{B} - \mu_0\vec{M})\cdot d\vec{s} = \mu_0 N i \quad , \quad \text{definiamo } \vec{H} \equiv \frac{\vec{B}}{\mu_0} - \vec{M} = \frac{\vec{B}_0}{\mu_0} \Rightarrow$$

$$\boxed{\oint_C \vec{H}\cdot d\vec{s} = Ni}$$

FORMA INTEGRALE

$\Rightarrow$ teorema di Stokes

$$\boxed{\vec{\nabla}\times\vec{H} = \vec{J}}$$

FORMA LOCALE

$$\boxed{\vec{B} = \mu\vec{H}} \qquad \left[\vec{D} = \varepsilon\vec{E}\right]$$

FERROMAGNETISMO

(CURVA DI ISTERESI)