$$(1+\chi)\varepsilon_0 E$$

$$D = \varepsilon_0 E + P.$$

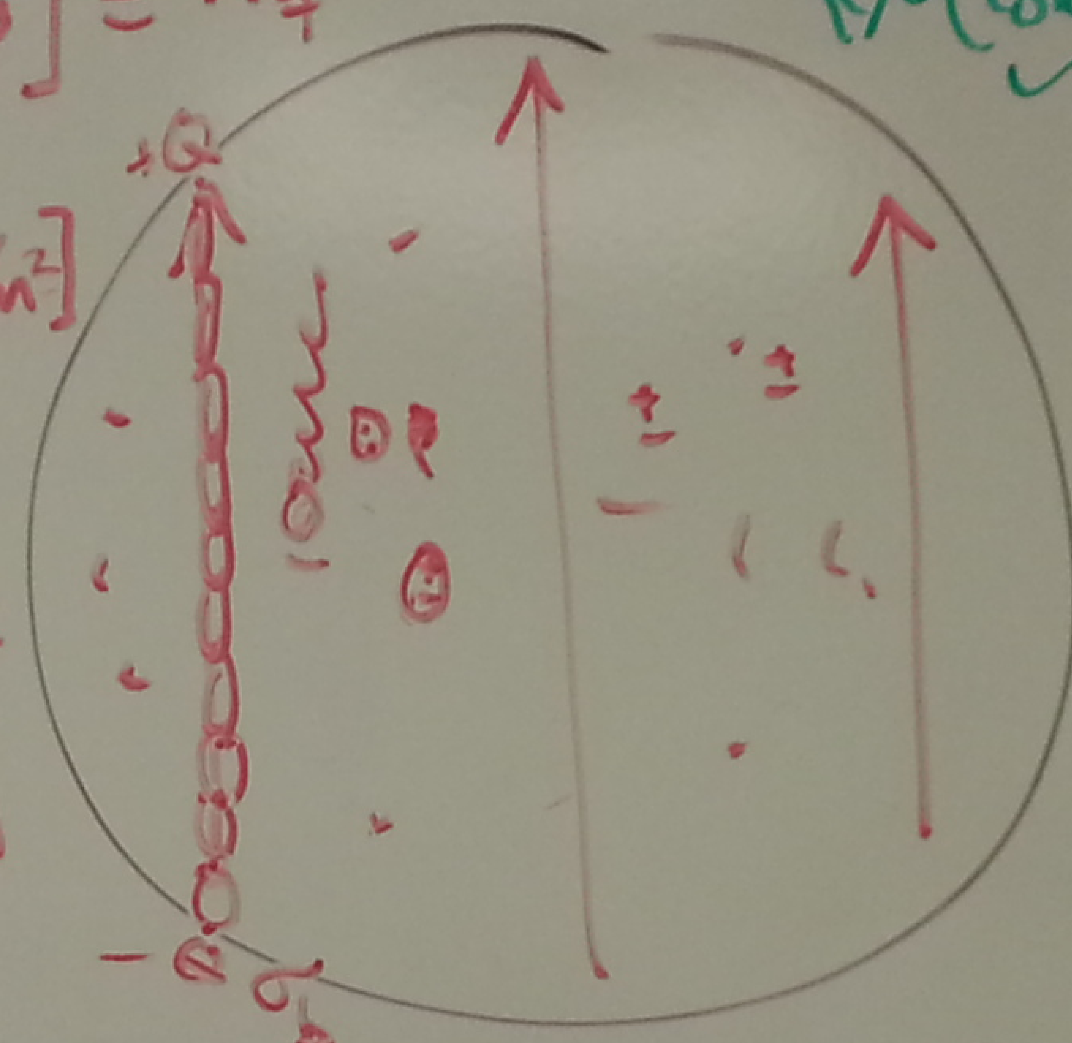
$$\nabla\cdot\varepsilon_0\vec E = \rho_t = \rho_f + \rho_b$$

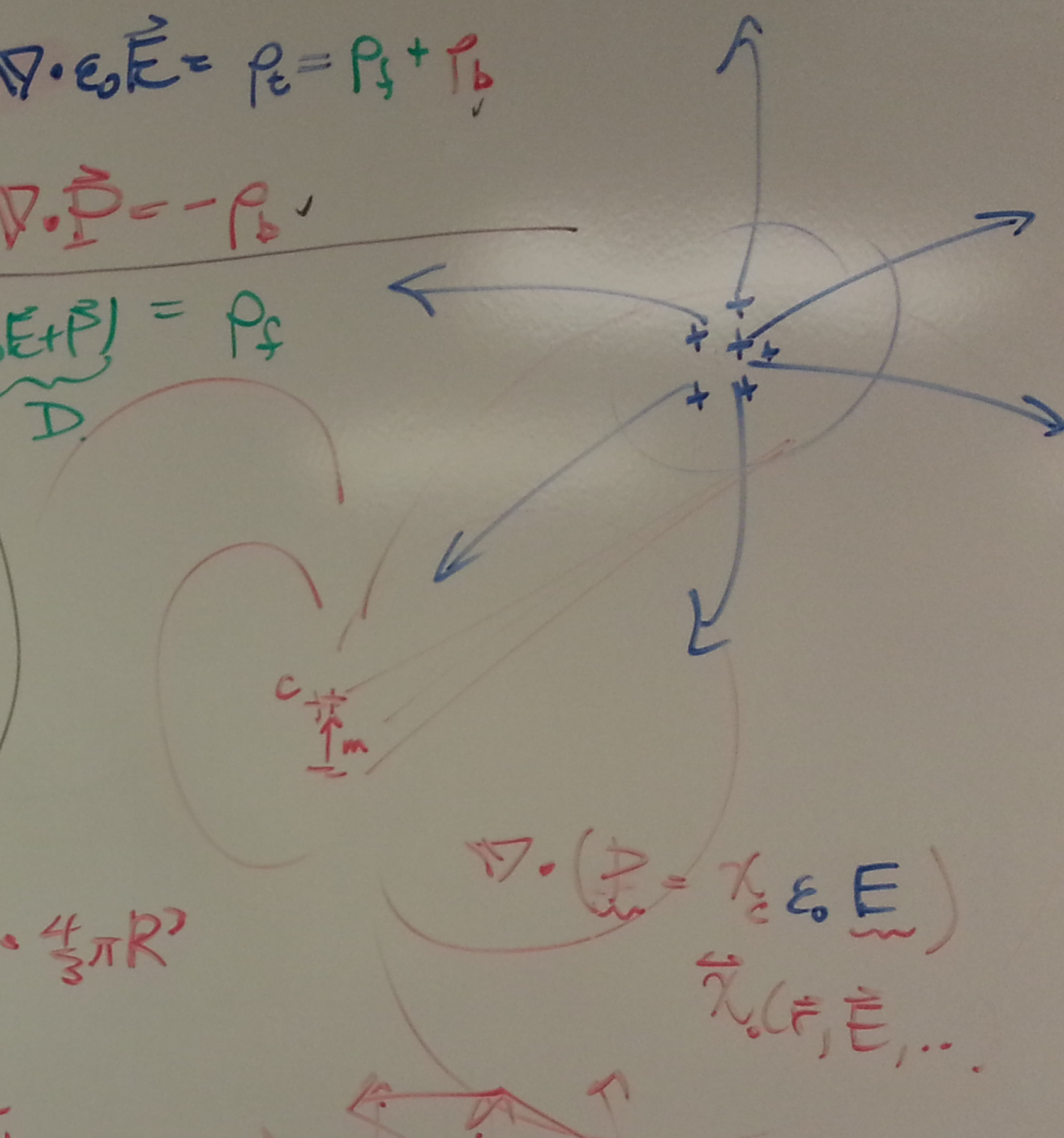
$$\nabla\cdot\vec P = -\rho_b$$

$$\nabla\cdot(\varepsilon_0\vec E+\vec P) = \rho_f$$

total. $\xrightarrow{1/m^3}$ density. $n = \frac{dN}{d\tau}$

0	q [C]	$\rho(\vec r) = \frac{dq}{d\tau}$ [C/m^3] $= nq$
xm 1	$\vec p = q\vec d$ [C·m] dipole moment.	$\vec P(\vec r) = \frac{d\vec p}{d\tau}$ [C/m^2] dip dens. $= n\cdot\vec p$ Polarization. $= \underbrace{n\alpha}_{\chi\varepsilon_0}\vec E$
2	$\vec p = \alpha\vec E$ polarizability.	$\Phi_P = \int\vec P\cdot d\vec a = [C]$

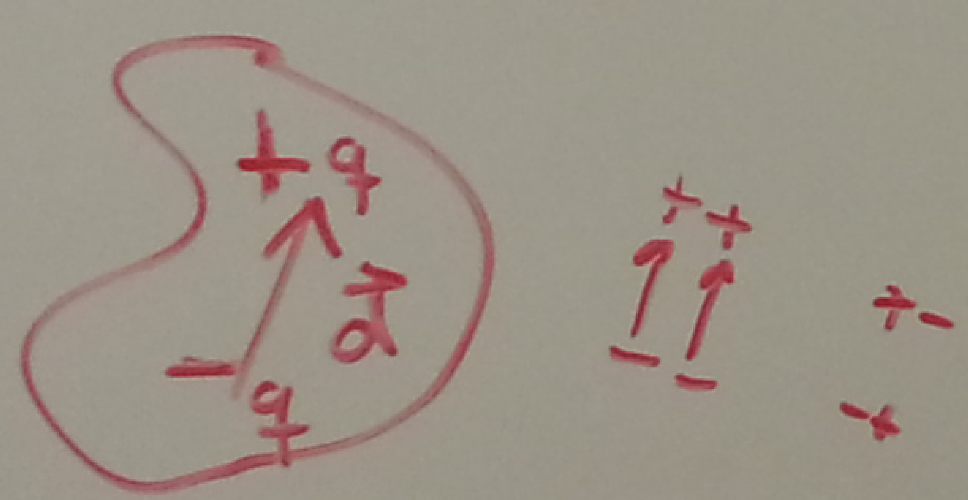


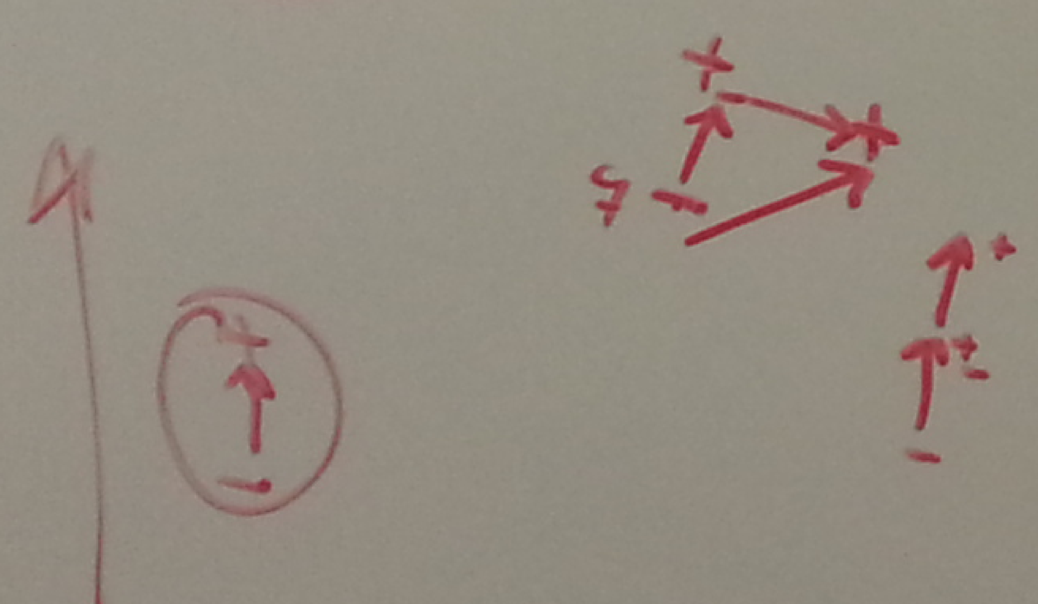


$\vec P\cdot\frac{4}{3}\pi R^3$

$\nabla\cdot\left(\frac{P}{\ldots} = \chi_e\varepsilon_0 E\right)$

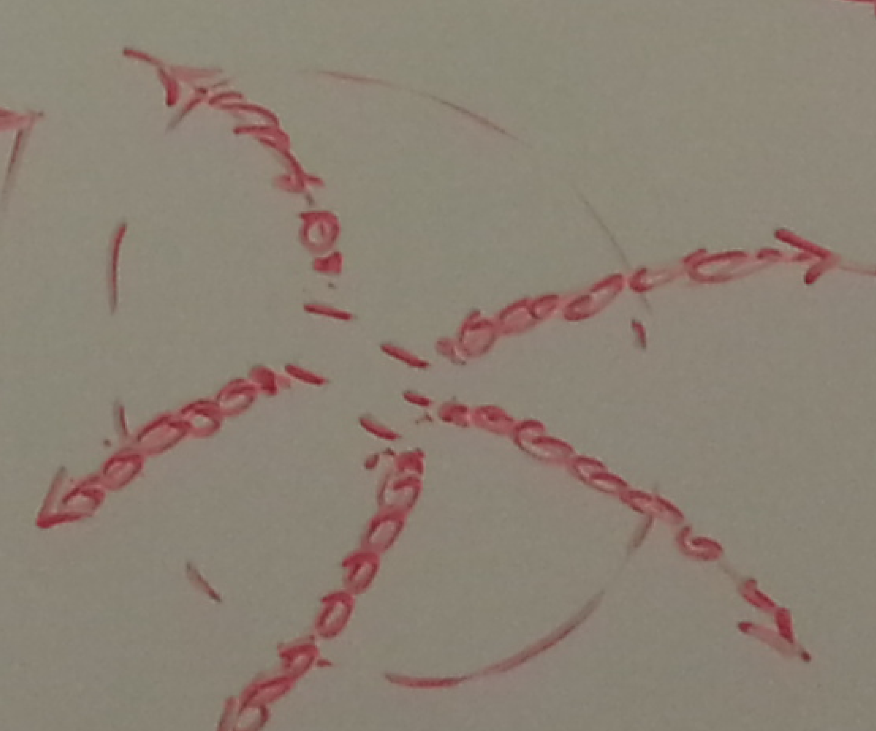
$\overleftrightarrow{\chi}_e(\vec r, \vec E, \ldots$

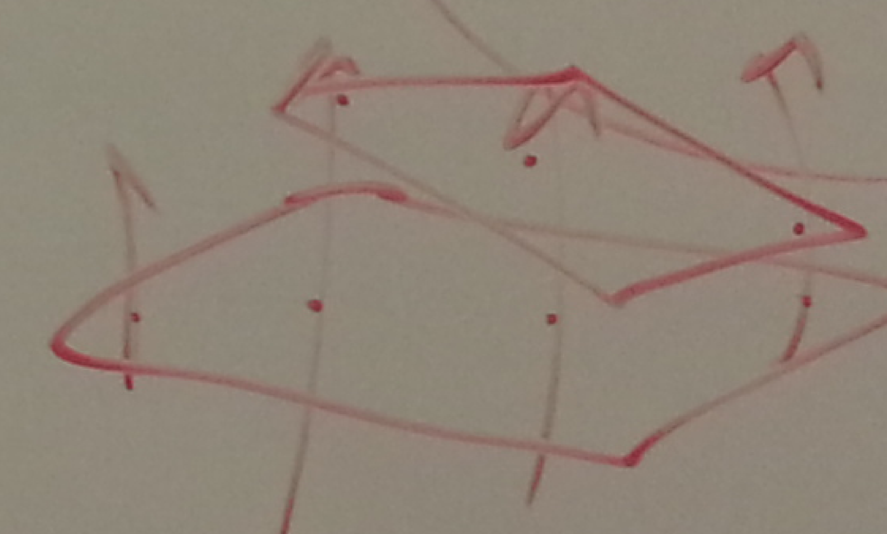




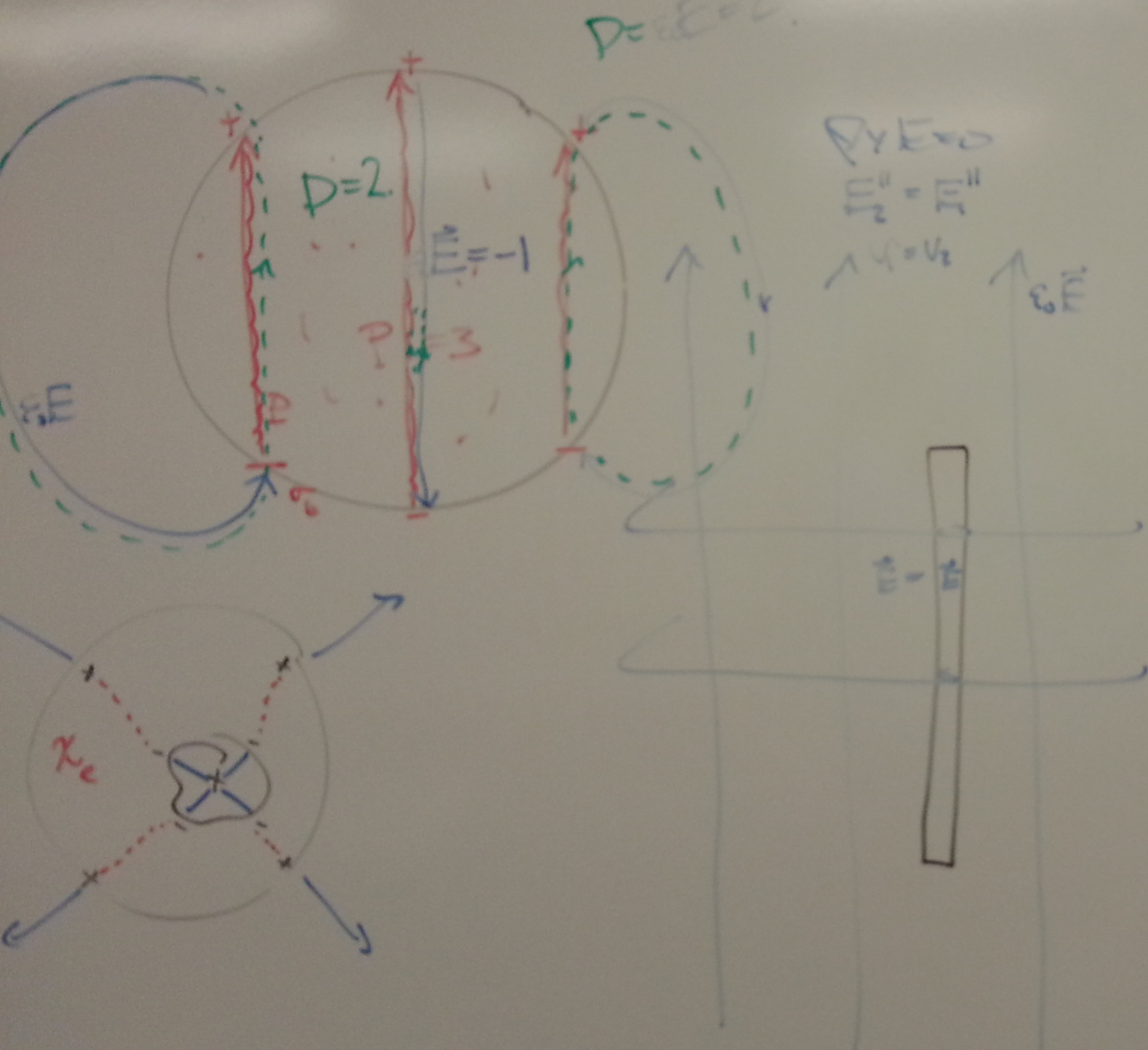
$\vec p_{tot} = N\vec p$

$n = \frac{dN}{d\tau}$ $\quad\frac{dN}{d\tau}\cdot\tau$

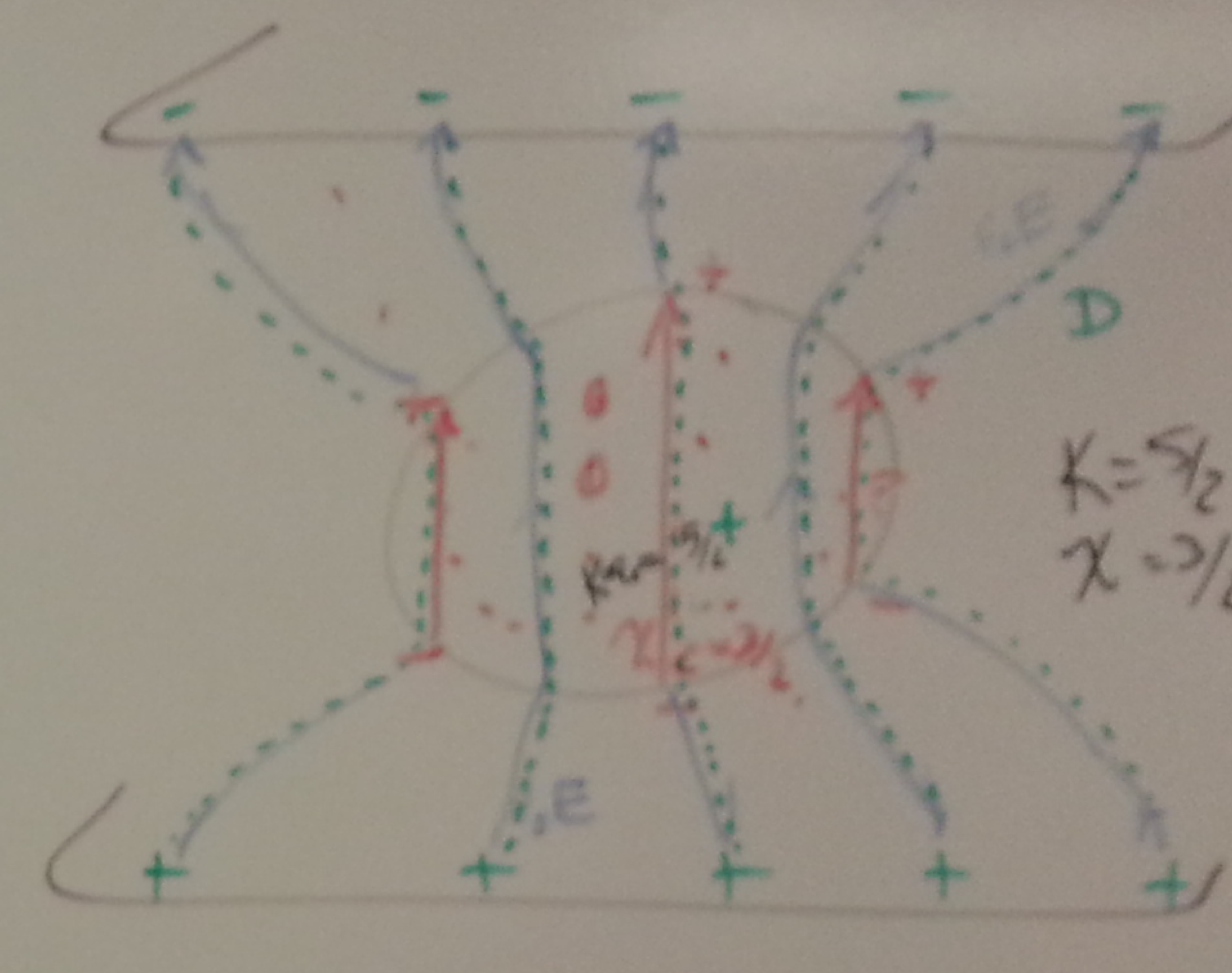




$\int F\cdot da = \Phi$



D = ε₀E = 2
D=2.
E = -1
P = 3
ε₀E
∇×E=0
$E_2^{\parallel} = E_1^{\parallel}$
ε₀E
χ_e



ε₀E
D
K=5/2
χ=3/2

B.V.P.

$\nabla \times E = 0$

$\nabla \cdot D = \rho_f$

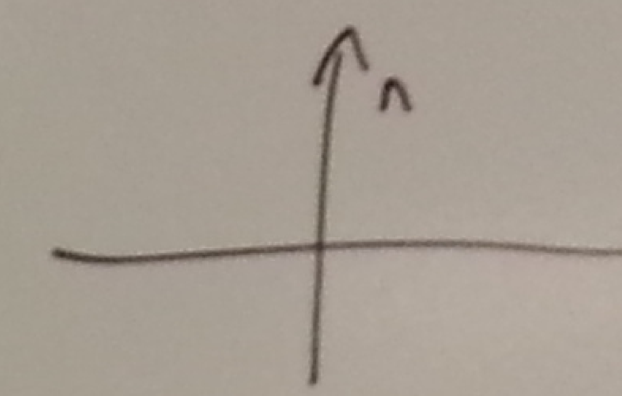
$E = -\nabla V$

$-\nabla \cdot \varepsilon \nabla V = \rho_f$

$\boxed{\nabla^2 V = 0}$

$$\boxed{\begin{array}{l} V_1 = V_2 \big|_\partial \\ -\varepsilon_2 \frac{\partial V_2}{\partial n}\Big|_\partial + \varepsilon_1 \frac{\partial V_1}{\partial n}\Big|_\partial = \sigma_f \end{array}}$$

$D_{2n} - D_{1n} = \sigma$



$V_2 = \sum_\ell (c_\ell r^\ell + d_\ell r^{-\ell-1}) P_\ell$

random dielec.

$V_1 = \sum_\ell (a_\ell r^\ell + b_\ell r^{-\ell-1}) P_\ell(\cos\theta)$

q

p

$\vec{p}$

σ_f

$\varepsilon_1 = \varepsilon_0(1+\chi_1)$

$\varepsilon_r = K$ dielectric const.

$\varepsilon_2 = \underbrace{\varepsilon_0(1+\chi_2)}$

permittivity

susceptibility.

$D = \varepsilon E$

external B.C.'s.

in

$V_q = \frac{q}{4\pi\varepsilon_0 r} = b_0 r^{-1} P_0(\cos\theta)$

$V_p = \frac{p}{4\pi\varepsilon_0} \frac{\cos\theta}{r^2} = b_1 r^{-2} P_1(\cos\theta)$

$V_Q = \frac{Q}{4\pi\varepsilon_0} \frac{P_2}{r^3} = b_2 r^{-3} P_2(\cos\theta)$

$c_0 = 0$..

out

$V_E = -E_0 r^1 \cos\theta = c_1 r^1 P_1(\cos\theta)$

$\vec{E} = \vec{E}_0 \hat{z}$

$V = -E_0 z$.

r