

Chap boubi crée par une boucle de courant



$$\vec{A}(r) = \frac{\mu_0}{4\pi r} \oint_C \vec{I} \cdot d\vec{l}$$

$$\vec{A}(r) \cdot \vec{a} = \frac{\mu_0}{4\pi r} \oint_C \underbrace{\vec{I} \cdot \vec{a} \cdot d\vec{l}}_{\text{circulation de } \frac{\vec{I} \cdot \vec{a}}{r}}$$

Th de Stokes

$$J = \int_{(C)} \frac{\vec{a} \cdot d\vec{l}}{r} = \iint_{\Sigma} \text{rot} \left(\frac{\vec{I} \cdot \vec{a}}{r} \right) \cdot d\vec{s}$$

$$\text{rot} \left(\frac{\vec{I} \cdot \vec{a}}{r} \right) = \cancel{\vec{I} \cdot \vec{a}} + \text{grad} \left(\frac{\vec{I} \cdot \vec{a}}{r} \right) \cdot \vec{a} \quad \text{où } \frac{1}{r} = \frac{1}{\sqrt{r^2}}$$

$$J = \iint_{\Sigma} (\vec{\text{grad}} \left(\frac{\vec{I} \cdot \vec{a}}{r} \right) \cdot d\vec{s} = \iint_{\Sigma} (d\vec{s} \wedge \text{grad} \left(\frac{\vec{I} \cdot \vec{a}}{r} \right)) \cdot \vec{a}$$

⑦

$$\vec{\text{grad}} \left(\frac{1}{r} \right) = -\frac{\vec{r}}{r^3} = -\text{grad} \left(\frac{1}{r} \right)$$

$$\vec{A}(r) = \frac{\mu_0}{4\pi r} \iint_{\Sigma} d\vec{s} \wedge \frac{\vec{I} \cdot \vec{a}}{r^2}$$

$$\text{qd } \|\vec{OP}\| \ll \|\vec{OM}\| \quad \vec{r} \approx \vec{OM}$$

$$\vec{A}(r) = \frac{\mu_0}{4\pi r} \iint_{\Sigma} d\vec{s} \wedge \frac{\vec{I} \cdot \vec{a}}{r^2} \quad \text{où } \vec{r} = \vec{OM}$$

$$\text{calcul de } \vec{B}(r) = \text{rot} \vec{A}$$

$$\text{rot}(\vec{a} \wedge \vec{b}) = \vec{a} \text{ div } \vec{b} - \vec{b} \text{ div } \vec{a} + \vec{b} \cdot \text{grad } \vec{a} - \vec{a} \cdot \text{grad } \vec{b}$$

$$\text{rot} \left(\vec{a} \wedge \frac{\vec{r}}{r^2} \right) = \vec{a} \text{ div} \left(\frac{\vec{r}}{r^2} \right) - \left(\vec{a} \cdot \text{grad} \right) \frac{\vec{r}}{r^2}$$

$$\text{div} \left(\frac{\vec{r}}{r^2} \right) = \text{div} \vec{r} \frac{1}{r^2} + \vec{r} \cdot \text{grad} \left(\frac{1}{r^2} \right) = \frac{3}{r^3} - \frac{2}{r^3} = \frac{1}{r^3}$$