Magentni fluks

Osnovi elektrotehnike 2

Semestar 2

KOT

- ✓ Fluks vektora elektrostatičkog polja, podsetnik!!!
- ✓ Fluks se uvek isto proračunava: posmatra se koliko linija neke vektorske veličine prolazi kroz zadatu površinu kroz koju tražimo fluks.

✓ Φ [Wb]

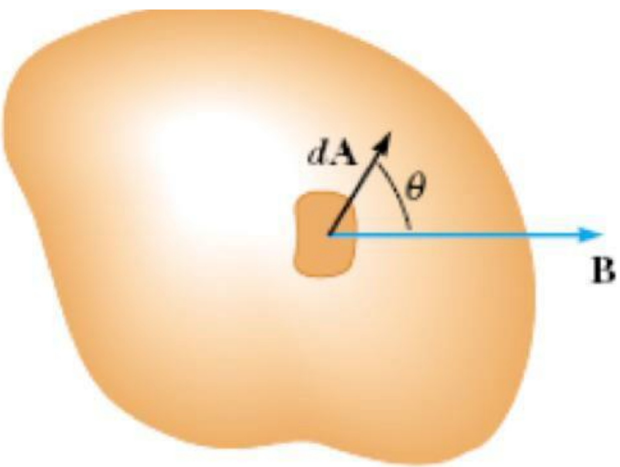
$$\Phi = \int_S \vec{B} \cdot d\vec{S}$$

$$\oint_S \vec{B} \cdot d\vec{S} = 0$$

Fluks vektora magnetne indukcije kroz zatvorenu povrsinu jednak je 0

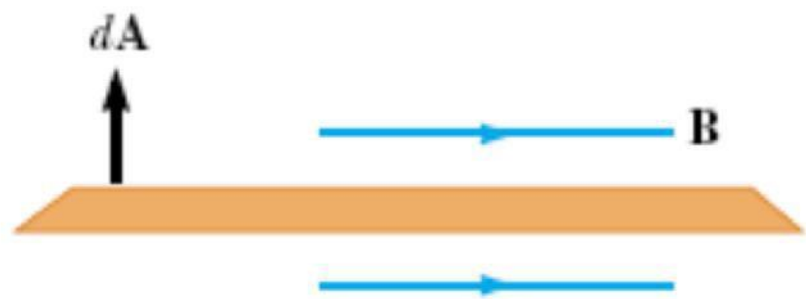
- Polje
- Linije polja
- Fluks jacine vektora magnentne indukcije
- Skalar

1 Wb = 1 T·m²



$$\Phi_m \int \vec{B} \bullet d\vec{A} = B \cdot A \cdot \cos\theta$$

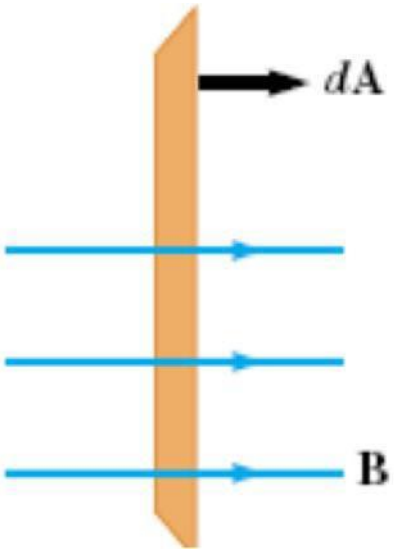
- Slucaj ugla $\angle B, dA = 90^{\circ}$



$$\Phi_m = \vec{B} \cdot \vec{A} \cdot \cos\theta$$

$$\Phi_m = \vec{B} \cdot \vec{A} \cdot \cos 90$$

$$\Phi_m = 0$$

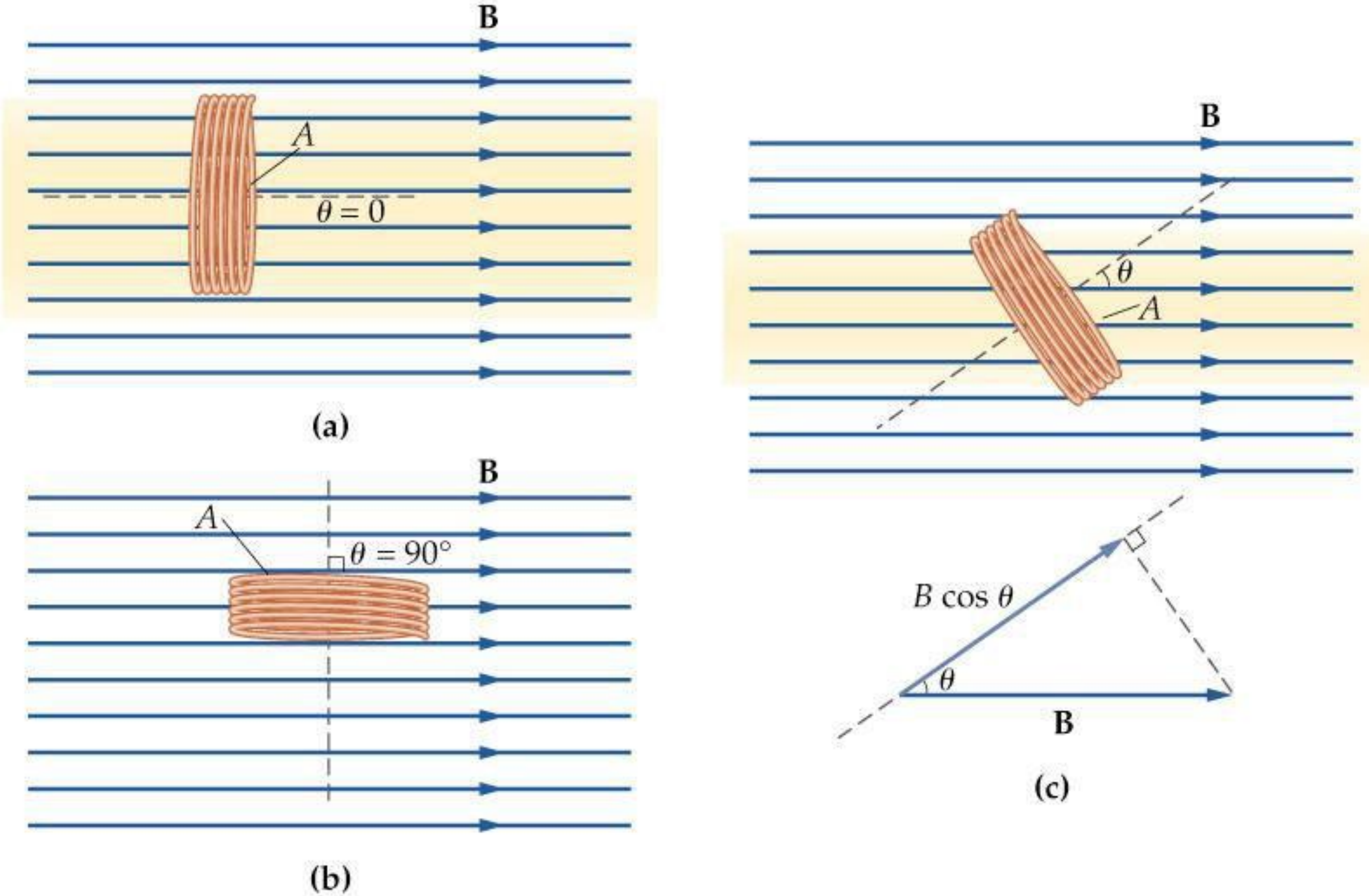


$\angle B, dA = 0^{\circ}$

$$\Phi_m = \vec{B} \cdot \vec{dA} \cdot \cos\theta$$

$$\Phi_m = \vec{B} \cdot \vec{A} \cdot \cos 0$$

$$\Phi_m = \vec{B} \cdot \vec{A}$$



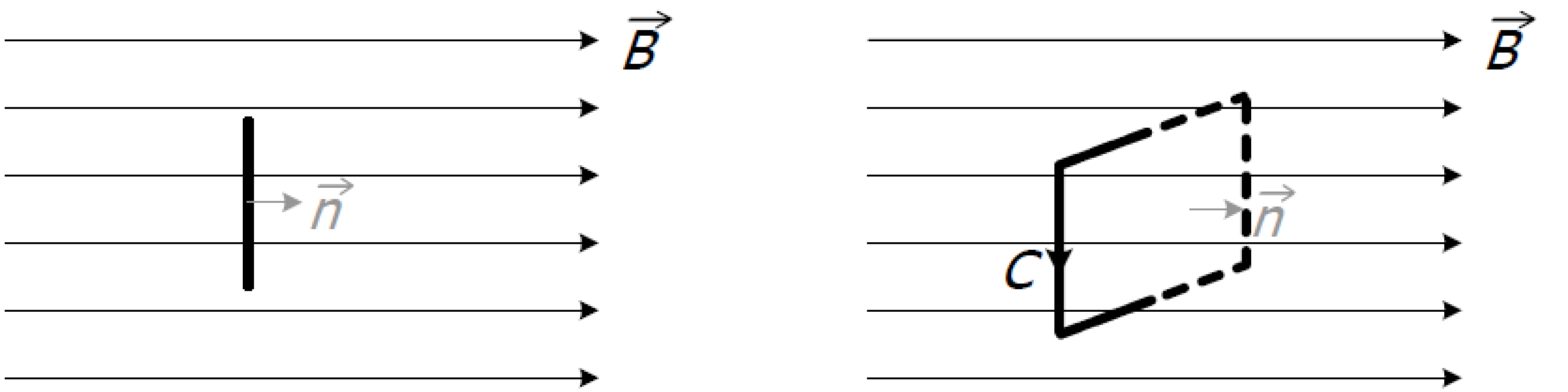
B
A
θ = 0
(a)
B
A
θ = 90°
(b)
B
θ
A
B cos θ
θ
B
(c)

3.1 Pravougaona kontura stranica $a = 2$ cm i $b = 5$ cm, nalazi se u homogenom magnetnom polju indukcije $B = 0{,}5$ T i postavljena je:

a) normalno na linije polja,

b) pod uglom od $\alpha = \dfrac{\pi}{6}$ u odnosu na linije polja.

Odrediti magnetni fluks kroz konturu.



$$\Phi = \int_S \vec{B} \cdot d\vec{S} \,.$$

$$\Phi = \int_S B \cdot dS \cdot \cos(\vec{B}, \vec{n}) = \int_S B \cdot dS$$

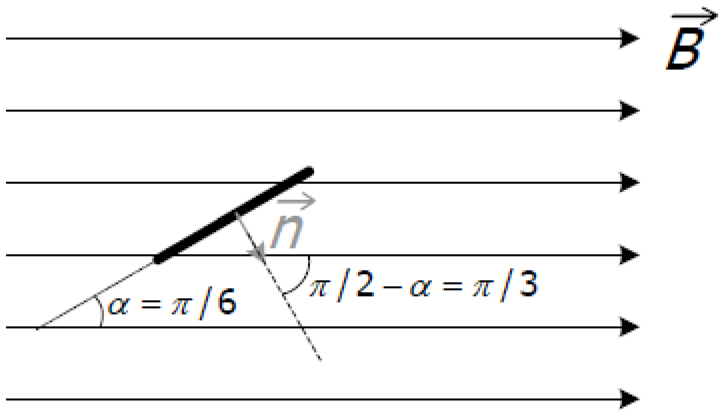
1

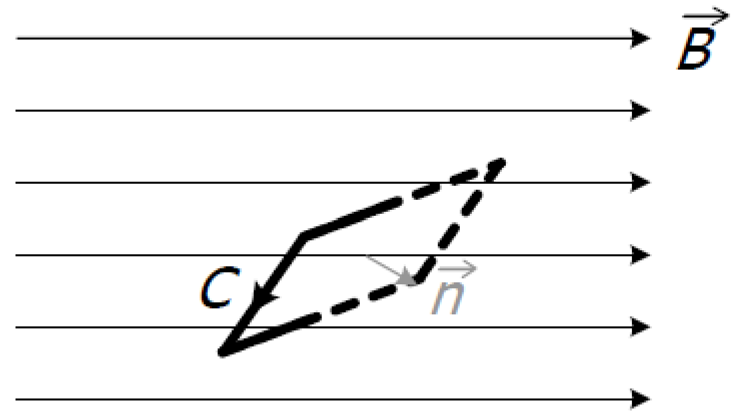
$$d\vec{S} = \vec{n} \cdot dS$$

$$\Phi = B \int_S dS \,.$$

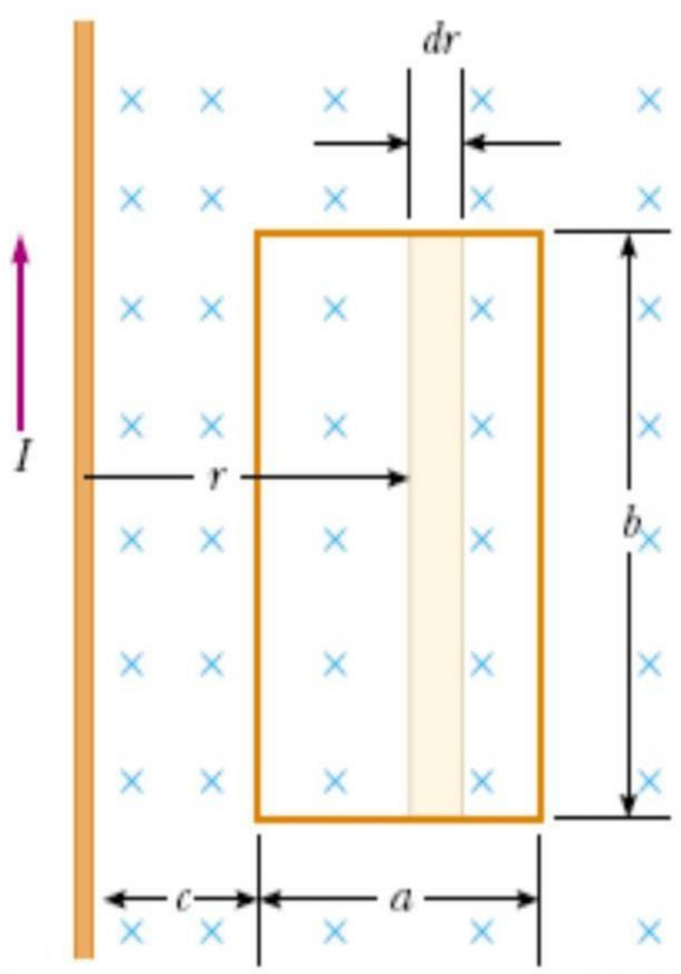
$$\pi / 2 - \pi / 6 = \pi / 3 \,.$$

$$\Phi = B \cdot S = B \cdot a \cdot b = 0{,}5\,\mathrm{T} \cdot 2 \cdot 10^{-2}\,\mathrm{m} \cdot 5 \cdot 10^{-2}\,\mathrm{m} = 5 \cdot 10^{-4}\,\mathrm{Wb} \,.$$





$$\Phi = \int_S \vec{B} \cdot d\vec{S} = \int_S B \cdot dS \cdot \cos(\vec{B}, \vec{n}) = \int_S B \cdot dS \cdot \cos\frac{\pi}{3} = \int_S \frac{1}{2} B \cdot dS = \frac{1}{2} B \int_S dS = \frac{1}{2} BS = 2{,}5 \cdot 10^{-4}\,\mathrm{Wb}$$



- Amperov zakon:
- Homogenost

$$\vec{B} = \frac{\mu_o \cdot I}{2 \cdot \pi \cdot r}$$

$$\Phi_m = \int \frac{\mu_o \cdot I}{2 \cdot \pi \cdot r} \cdot \vec{dA}$$

$$\vec{dA} = b \cdot \vec{dr}$$

$$d\Phi_m = \frac{\mu_o \cdot I}{2 \cdot \pi \cdot r} \, b \cdot dr$$

$$\Phi_m = \int_c^{c+a} \frac{\mu_o \cdot I}{2 \cdot \pi \cdot r} \cdot b \cdot dr$$

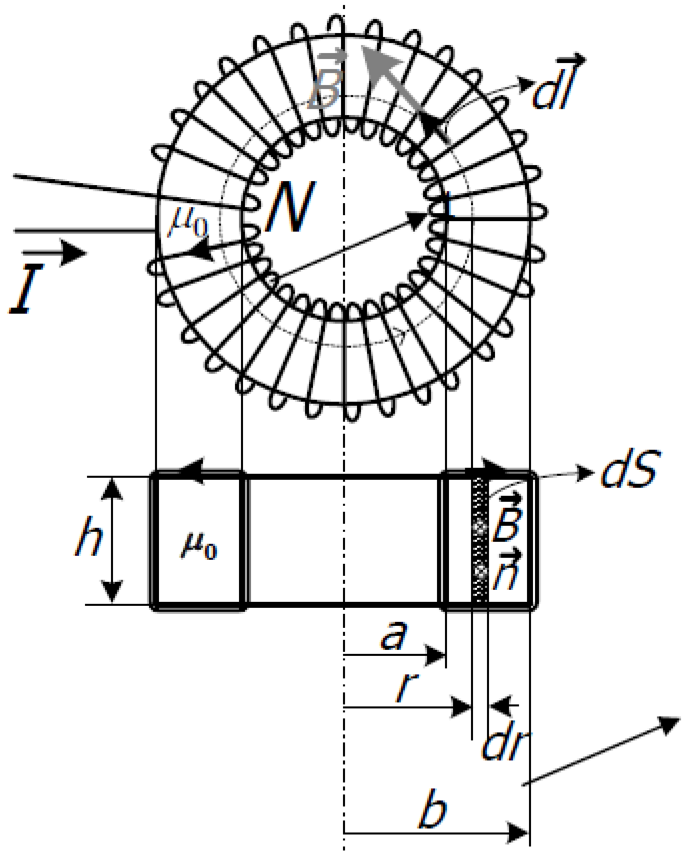
$$\Phi_m = \frac{\mu_o \cdot I \cdot b}{2 \cdot \pi} \cdot \int_c^{c+a} \frac{1}{r} \cdot dr$$

$$\Phi_m = \frac{\mu_o \cdot I \cdot b}{2 \cdot \pi} \cdot \int_c^{c+a} \frac{1}{r} \cdot dr$$

$$\Phi_m = \frac{\mu_o \cdot I \cdot b}{2 \cdot \pi} \cdot \ln|r| \Big|_c^{c+a}$$

$$\Phi_m = \frac{\mu_o \quad I \cdot b}{2 \cdot \pi} \cdot \left(\ln|c + a| - \ln|c| \right)$$

$$\Phi_m = \frac{\mu_o \cdot I \cdot b}{2 \cdot \pi} \cdot \ln\left| \frac{c + a}{c} \right|$$



$$\oint_C \bar{B}\cdot d\bar{l} = \mu_0 \sum_k I_k$$

$$\oint_C B\cdot dl\cdot \cos(\bar{B}, d\bar{l}) = \mu_0 N I$$

$$B\cdot 2\pi r = \mu_0 N I$$

$$B = \frac{\mu_0 N I}{2\pi r}, \qquad a < r < b$$

$$\Phi_0 = \int_S \bar{B}\cdot d\bar{S} = \int_S B\cdot dS\cdot \cos(\bar{B}, \bar{n}) =$$

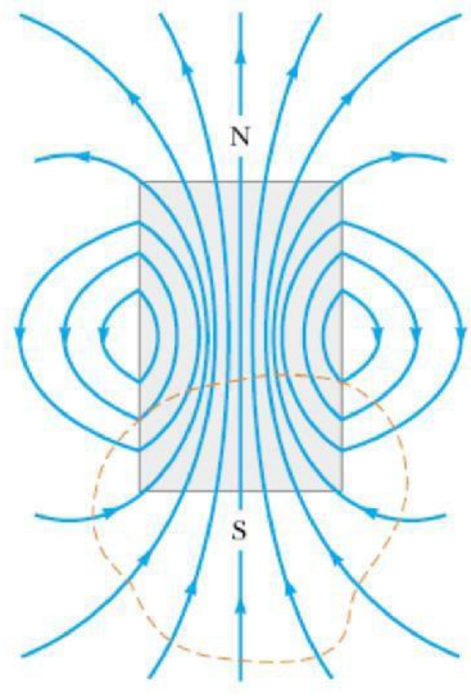
$$= \int_a^b \frac{\mu_0 N I}{2\pi r}\cdot h\cdot dr = \frac{\mu_0 N I}{2\pi} h \ln\frac{b}{a}$$

$$\Phi = N\cdot \Phi_0$$

$$\Phi = N\cdot \Phi_0 = \frac{\mu_0 N^2 I}{2\pi} h \ln\frac{b}{a}$$

Zakljucak

- Linije magngnetnog polja su neprekidne.
- Magnento polje je bezizvorno.
- Za svaku zatvorenu površinu, broj linija magnetnog polja koji ulazi u datu površinu jednak je broju linija koji iz iste izlazi



- The known sources of magnetic fields are magnetic dipoles (current loops).
- All magnetic field effects in matter can be explained in terms of magnetic dipole moments (effective current loops) associated with electrons and nuclei.

- Magnetic flux for multiple loops: