

Ch. 11 Prob 45

$$r = 0.65 \times 10^{-15} \text{ m}$$

$$I = 1.05 \times 10^4 \text{ A}$$

$$B = 2.50 \text{ T}$$

Find the maximum torque on the proton.

Magnetic moment of the proton is

$$\mu = |\vec{\mu}| = |I \cdot \vec{A}| = I \pi r^2 = (1.05 \times 10^4 \text{ A}) \pi (0.65 \times 10^{-15} \text{ m})^2$$
$$\mu = 1.39 \times 10^{-26} \text{ A} \cdot \text{m}^2$$

Torque on it is

$$\vec{\tau} = \vec{\mu} \times \vec{B}$$

Magnitude is  $\tau = \mu B \sin \theta$

Maximum torque is  $\tau = \mu B$

substitute in the appropriate values gives

$$\tau = (1.39 \times 10^{-26} \text{ A} \cdot \text{m}^2)(2.50 \text{ T})$$

$$\tau = 3.48 \times 10^{-26} \text{ N} \cdot \text{m}$$