Question #83187, Physics / Electromagnetism |

you and a few friends were to charge up your hair by rubbing a balloon against your head, you could run in a circle and create a current. What is the magnitude and the direction of the magnetic field that would be created in the middle of this circle?

During friction of the rubbing a balloon, a positive charge is formed on the hair. The total charge that was formed on the hair is **n -** the number of electrons passed to by rubbing a balloon.

Current that occurs when running in a circle - $\boldsymbol{I = \frac{e}{T} = N\frac{ne}{T}}$, where **N** - number of friends, **n** – number of electrons and **e** - charge of electron, T-period

Magnetic moment $\boldsymbol{p_m = IS, S = 2\pi r^2}$, then $\boldsymbol{p_m = N\frac{ne}{T}2\pi r^2}$

the direction of the magnetic field is shown in the figure

magnitude of the magnetic field - $\boldsymbol{B = \mu_0\mu\frac{I}{2r} = \mu_0\mu N\frac{ne}{2rT}}$

Let's try to estimate the magnitude of the magnetic moment

Let – N = 4, n = 50, T = 4 s, r = 2 m

$e = 1.6 \times 10^{-19}\ C, \mu_0 = 4\pi \times 10^{-7}\ H/m$

$$p_m = 4 \cdot \frac{50 \cdot 1.6 \times 10^{-19}}{4} 2 \cdot 3.14 \cdot 4 = \boldsymbol{2.1 \times 10^{-16}\ A \cdot m^2}$$

$$B = 4\pi \times 10^{-7} \cdot 4 \cdot \frac{50 \cdot 1.6 \times 10^{-19}}{2 \cdot 2 \cdot 4} = \boldsymbol{2.51 \times 10^{-24}\ Wb}$$