

Answer on Question #82947, Physics / Electromagnetism

Question:

Calculate a rough estimate of the magnitude and direction of the electric field near one of your earlobes produced by the electrons in both eyes. You can assume the charge from the electrons acts like it is all in the centre of each eyeball

Solution:

Let's assume that the eye volume equals to 3 cm^3 and it consists mainly from water; then the number

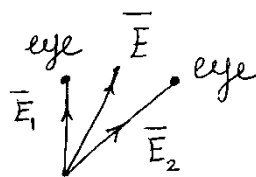
of molecules is $n = \frac{3}{18} 6 \cdot 10^{23} = 10^{23}$ and the proper electrons charge equals to

$$q = 10^{23} \cdot 1.6 \cdot 10^{-19} = 0.29 \cdot 10^6 \text{ (K)},$$

For the estimation we can regard charges and earlobe situated in the tops of the square with the side equals to 0.1 m , then the net electric field strength should be

$$E = \frac{9 \cdot 10^9 \cdot 0.29 \cdot 10^6}{10^{-2}} \sqrt{\left(1 + \frac{\sqrt{2}}{4}\right)^2 + \left(\frac{2}{16}\right)} = 2.6 \cdot 10^{17} \cdot 1.4 = 3.6 \cdot 10^{17} \text{ (V/m)}.$$

The direction in acc. with the fig.



The answer:

$E = 3.6 \cdot 10^{17} \text{ V/m}$, the direction - see the fig.

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