# Physics II

## Electric Charge

**Problem 1**.- A helicopter accumulates -340μC of electric charge due to friction with air. Calculate:
   a) The number of excess electrons
   b) The mass of these electrons

**Solution**: To find the number of electrons we divide the total charge by the charge of one electron:

$$N = \frac{-340 \times 10^{-6} C}{-1.6 \times 10^{-19} C} = \textbf{2.1} \times \textbf{10}^{\textbf{15}} \textbf{ electrons}$$

To find the mass of the electrons we multiply the number of electrons times the mass of one of them:

$$mass = Nm = (2.1 \times 10^{15})(9.1 \times 10^{-31}) = \textbf{1.9} \times \textbf{10}^{\textbf{-15}} \textbf{ kg}$$

**Problem 2.-** Calculate the total charge in space if the density were $\rho = 1 \frac{\mu C}{m^3}$ at the origin and dropped ½ for each meter away from it.

**Solution:** First, we write the equation of the density as a function of the distance to the origin.

$$\rho = \rho_\circ 2^{-r} = \rho_\circ e^{-r \ln 2}$$

We find the total charge integrating over all the space.

$$Q = \int_0^\infty \rho_\circ e^{-r \ln 2} 4\pi r^2 dr$$

$$Q = \frac{4\pi\rho_\circ}{(\ln 2)^3} \int_0^\infty e^{-r} r^2 dr = \frac{8\pi\rho_\circ}{(\ln 2)^3} = \textbf{75.5 μC}$$