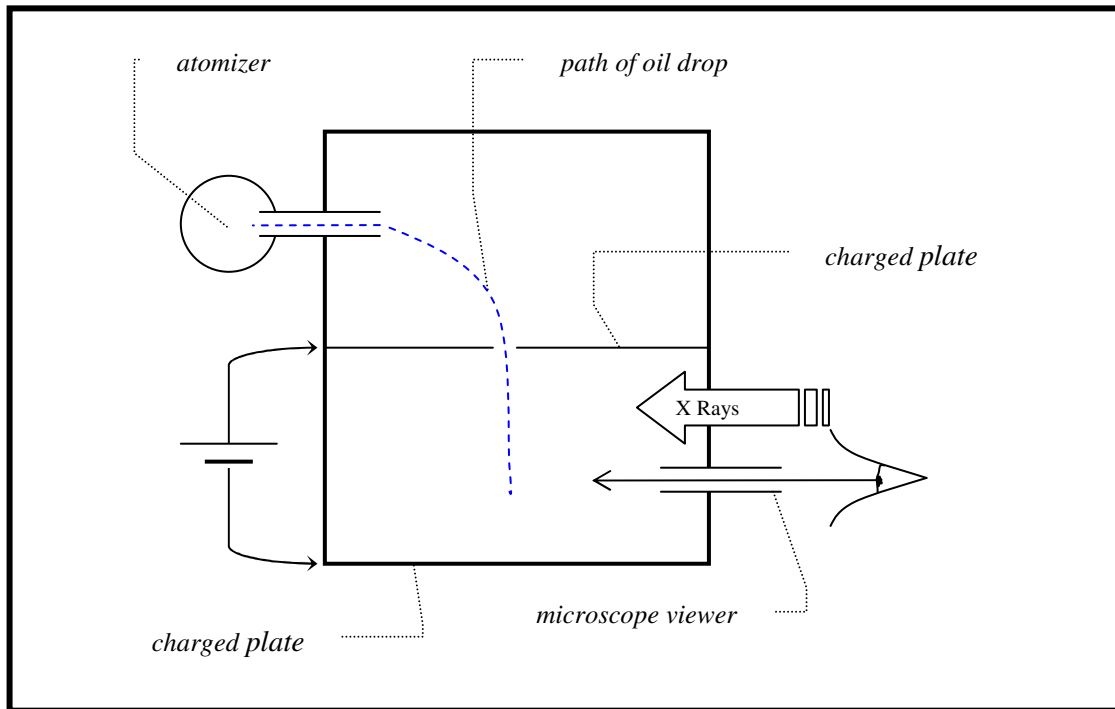# Milliken's Oil Drop Experiment

Method:

- An atomizer sprayed tiny droplets of oil out, some of these fell through a hole in the upper charged plate.
- By illuminating the lower space with X-rays, Milliken was able to give the droplets which fell through the gap a charge.
- Since the two charged plates produce an electric field, the charged droplets experience a force from the field.
- By adjusting the electric field strength, Milliken was able to alter the electric force on the droplets.
- If Milliken got the electric force to equal the gravitational force which pulled the droplets down, then they would be suspended – "floating".
- Once suspended Milliken noted the voltages and calculated the mass of the droplets, in order to find the charge on the droplet.

Calculations:

Whilst each particle is suspended, the electric force on it is the same as the gravitational force it experiences. So …

$$F_G = F_E$$

since $F_E = EQ$
and $F_G = W = mg$
$$mg = EQ$$

from the terminal velocity of the oil drops Milliken was able to find m the mass of an oil drop.

since $E = \dfrac{V}{d}$, where d is the distance between the charged plates

$$mg = \frac{QV}{d}$$
$$Q = \frac{dmg}{V}$$

Results

- Milliken observed that for each droplet of oil, the charge was a multiple of -1.6×10^{-19}
- He therefore deduced that the charge on the smallest charge-carrying unit must be -1.6×10^{-19}, and thus that was the charge on an electron.