Modern Physics

Frank Hertz Experiment

Problem 1.- When sodium decays from its most prominent excited state to the ground state it emits a photon of 590 nm. Calculate at what voltage you expect the first drop in current in the Frank Hertz experiment if you use Na vapor in the tube.

Solution: In a collision of an electron with a sodium atom, you need to have at least enough energy to excite it to its excited state. The voltage necessary to reach that energy can be calculated as follows:

$$eV = \frac{hc}{\lambda} \rightarrow V = \frac{hc}{e\lambda} = \frac{(6.67\times10^{-34})(3\times10^{8})}{(1.6\times10^{-19})(590\times10^{-9})} = \mathbf{2.12V}$$

The first drop should happen at 2.1 volts, the second at 4.2 volts and so on.