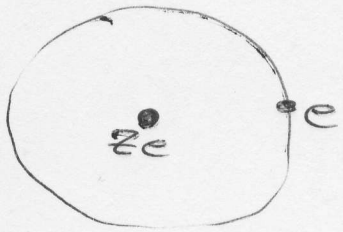
Phys 606

Problem 3

$$P = \frac{2}{3}\frac{e^2}{c^3}|\dot{v}|^2$$



if electron orbits around nucleus

$$\frac{mv^2}{r} = \frac{Ze^2}{r^2}$$ centripetal acceleration

$$|\dot{v}| = \frac{v^2}{r} = \frac{Ze^2}{mr^2}$$, at the same time

total energie of the system =

$$E = \frac{mv^2}{2} - \frac{Ze^2}{r} = -\frac{1}{2}\frac{Ze^2}{r}$$

but we know that

$$P = \frac{dE}{dt} = \frac{1}{2}\frac{Ze^2}{r^2}\frac{dr}{dt} = \frac{2}{3}\frac{e^2}{c^3}\left(\frac{Ze^2}{mr^2}\right)^2$$

$$r^2 dr = \frac{4}{3}\frac{Ze^2}{c^3 m^2}dt$$

$$t = \frac{3}{4}\frac{r^3 m^2}{Ze^2}c^3 \sim 10^{-11}\,s$$