LECTURE 1 : GENESIS OF QUANTUM THEORY

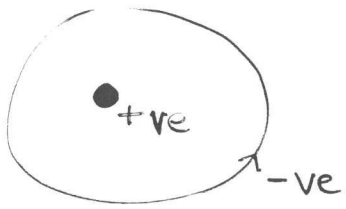
AT START OF 20th C THERE WERE NUMBER OF OUTSTANDING PROBLEMS TO DO WITH STRUCTURE OF MATTER

BROADLY SPEAKING TWO AREAS

① ATOMS : STABILITY ?

STRUCTURE ?

RADIATION ?



KNOWN THAT ATOMS HAD BOTH +ve AND -ve CHARGES IN BOUND STATE

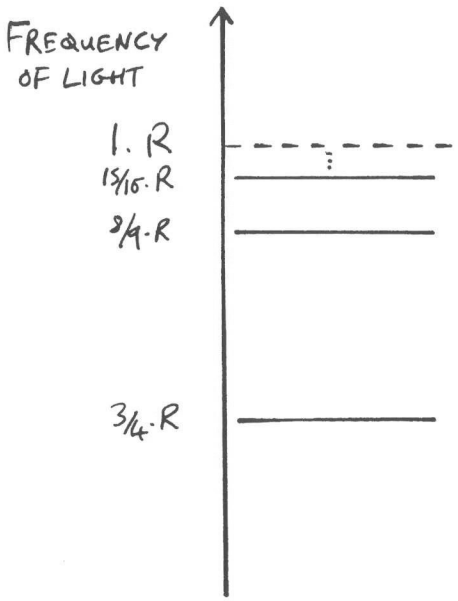
- BUT IF ONE ORBITS AROUND OTHER THEN CLASSICAL EM THEORY PREDICTS SYSTEM RADIATES ENERGY (EM RADIATION DUE TO ACCELERATING CHARGES) AND COLLAPSES IN VERY SHORT TIME — SO

WHY ATOMS STABLE ??

MOREOVER, EXPERIMENTS WITH DISCHARGE TUBES BY BALMER, LYMAN, AND OTHERS SHOWED THAT

- RADIATION (IR, VISIBLE, UV, ETC) EMITTED BY EXCITED ATOMS CAME IN **DISCRETE SPECTRAL LINES**

eg, BALMER SERIES FROM HYDROGEN



R = Rydberg constant

$$\frac{\nu}{c} = R\left(1 - \frac{1}{n^2}\right)$$

$n = 2, 3, 4, 5, \ldots$

SEVERAL OTHER SERIES HAD ALSO BEEN IDENTIFIED TOGETHER WITH THE 'RULE' FOR THE FREQUENCIES

WHY DISCRETE SPECTRUM?

WHY SIMPLE RULES FOR ν (FOR n)?

② BLACK BODY RADIATION

ALL BODIES AT TEMP $T > 0$ EMIT EM RADIATION (AND ABSORB IT IF IN EQUILIBRIUM)

SCHEMATICALLY A BLACK BODY CAN BE MADE VIA