Physics
Theory Part 18

Topics: Radio Physics/ Atomic Physics

Course: B.Sc/ Physics

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Find the distance, r_0 of closest approach of α-particle

Q1: $v = 1.75 \times 10^7$ m/s, $m = 6.67 \times 10^{-27}$

Kinetic Energy, $K.E = \frac{1}{2} m v^2$

$= 0.5 \times 6.67 \times 10^{-27} \times (1.75 \times 10^7)^2$

$= 0.5 \times 6.67 \times 3.06 \times 10^{-27+14} \cong 10.2 \times 10^{-13}$ J.

If r_0 = distance of closest approach of α-particle towards nucleus.

At this distance (r_0) whole K.E will be balanced by Electrostatic repulsion energy between α-particle & Au Nucleus.

$$\therefore \frac{1}{2} m v^2 = \frac{1}{4\pi\epsilon_0} \frac{(Ze)(2e)}{r_0}$$

$$\text{or, } 9 \times 10^9 \times \frac{2 \times 79 \times (1.6 \times 10^{-19})^2}{r_0} = 10.2 \times 10^{-13}$$

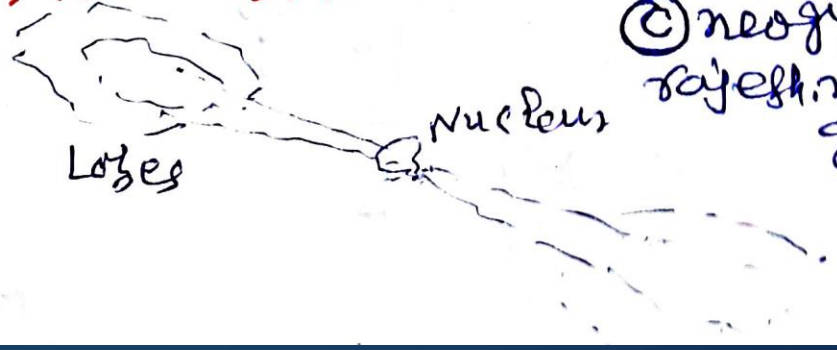
$$\text{or, } r_0 = \frac{9 \times 2 \times 79 \times 2.56 \times 10^{-38}}{10.2 \times 10^{-13}}$$

$$= \boxed{35.68 \times 10^{-15} \text{ m}}$$

This distance is well inside the atom of Au and it is around 8-9 Nuclear ~~distance~~ diameter from centre of the Gold nucleus. This shows that inside the atom is almost empty, only a very small hard nucleus is present at the centre of it.

Radio-Physics:- Explain Radio-Galaxies

Galaxies having strong radio sources in the range of 10^{41} to 10^{46} ergs are known as "Radio Galaxies". For the most part, radio galaxies are giant ellipticals. Radio galaxies are best known for their extensive double radio sources, shining by synchroton radiation as electrons spiral through magnetic fields at relativistic speed. Emission in the radio wavelength is more dominant than in the visible region. Radio galaxies are driven by non-thermal emission. Centaurus A is an example of an extended radio galaxy with outer lobes $65 \times 10^4 - 1.35 \times 10^6$ LYs in diameter.



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