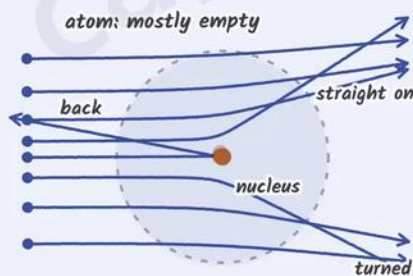




Rutherford found the nucleus, Bohr made it stable, hydrogen's spectrum proved him right

Alpha-particle scattering, what it showed

- alpha particles (charge $+2e$) fired at a thin gold foil, a detector swung round it
- most passed straight through, undeflected: the atom is mostly empty space
- a small fraction scattered through large angles, a very few bounced almost straight back
- large-angle scattering meant a small, massive, positively charged core doing the repelling: the nucleus



a beam at every aim: most go straight on, a few pass close and turn, one aimed almost at the nucleus comes back (nucleus drawn far larger than real)

One alpha: impact parameter and closest approach

closest approach, head-on: all its K becomes potential energy

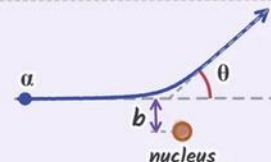
$$d = \frac{2 Z e^2}{4\pi\epsilon_0 K}$$

aimed head-on, $b = 0$

$$\theta = 180^\circ$$

aimed far off, large b

$$\theta \approx 0$$

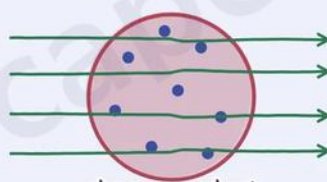


one alpha aimed a distance b to one side of the nucleus (the impact parameter) leaves turned through the scattering angle θ

the smaller b , the larger θ . only a nearly head-on alpha turns back, and few are aimed that close: so large angles are rare

Thomson's model vs Rutherford's model *

Thomson

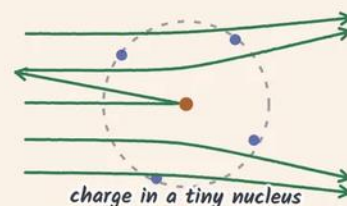


charge spread out
every alpha only nudged

the same alphas into Thomson's atom: charge spread through it can only nudge them

- positive charge spread through the whole atom
- electrons embedded in it, like fruit in a pudding
- predicts only small deflections, never a large one

Rutherford



charge in a tiny nucleus
most straight, a few turn back

into Rutherford's atom: most pass straight through, one passing close to the tiny nucleus turns back

- positive charge concentrated in a tiny central nucleus
- electrons revolve at a distance, around mostly empty space
- explains large-angle scattering, close approaches to the concentrated charge

Rutherford's model had one flaw of its own: an orbiting electron should radiate energy continuously and spiral into the nucleus. it never does

