

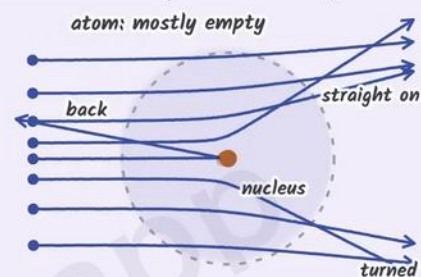
Rutherford found the nucleus, Bohr made it stable, and the nucleus itself hides the energy of stars and reactors

Thomson's atomic model

- Thomson discovered the electron (1897) from cathode rays, disproving Dalton's indestructible atom
- plum-pudding model (1898): a uniform positive sphere with embedded electrons, net charge zero
- explains why only negative electrons are ever emitted, and why atoms form ions
- could not explain the Geiger-Marsden scattering result that followed

Geiger-Marsden experiment

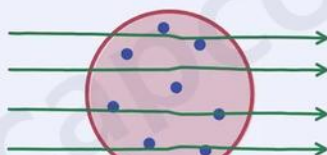
- alpha particles (helium nuclei) aimed at thin gold foil, flashes counted at each angle θ
- most alpha particles passed straight through: the atom is mostly empty space
- about 1 in 8000 deflected past 90° , a very few bounced back near 180°
- large-angle scattering needs a small, massive, positive core, not Thomson's spread-out charge



alphas at every aim: most pass straight on, a few near a nucleus turn, one aimed almost at it comes back (nucleus drawn far larger than real)

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

- charge and 99.9% of mass in a tiny nucleus, ~ 10 fm
- electrons revolve around it, mostly empty space between
- explains large-angle scattering as a close nuclear approach

nucleus $\sim 10^{-5}$ times the atom's size, $\sim 10^{15}$ times denser than the atom as a whole