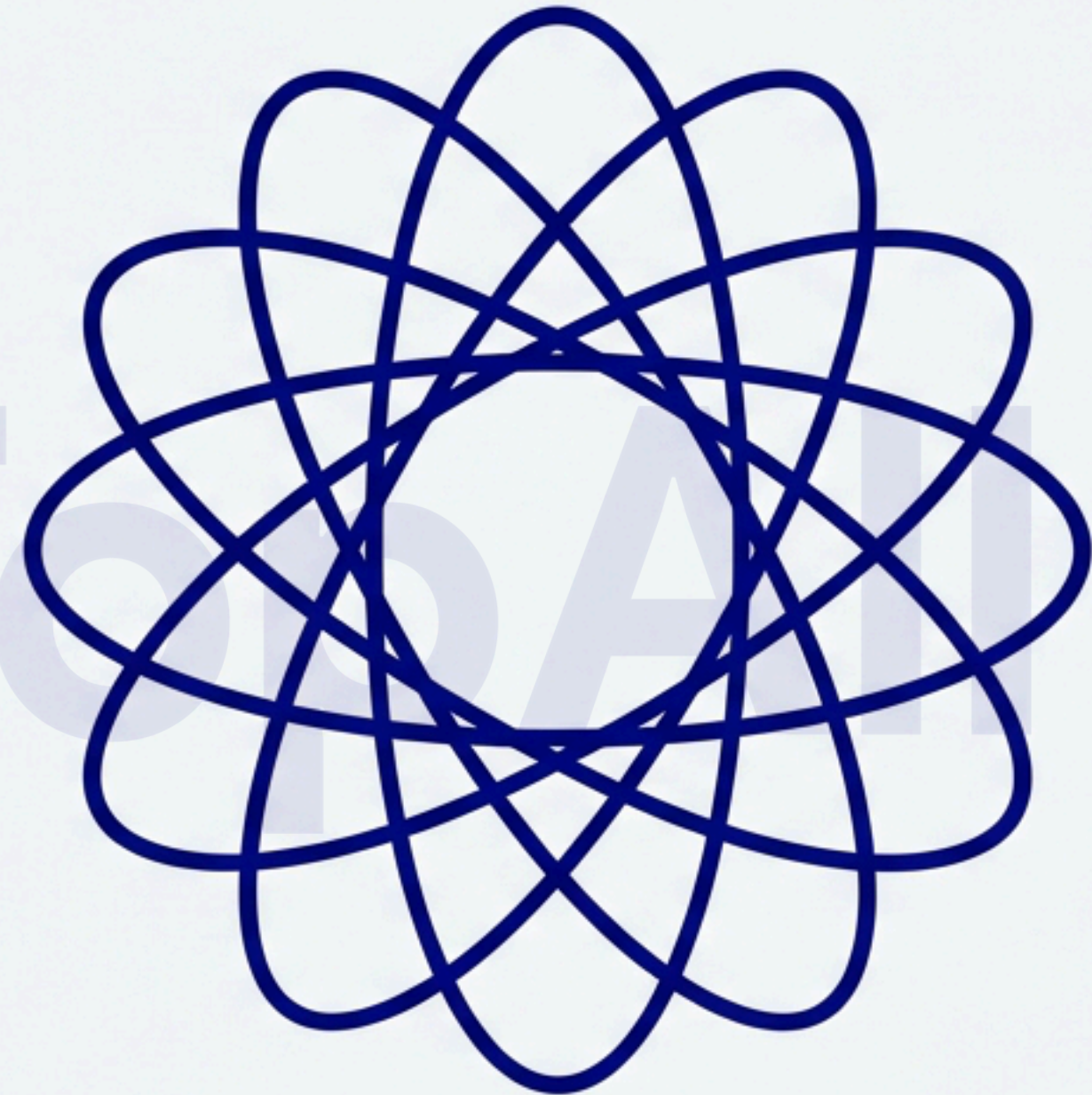


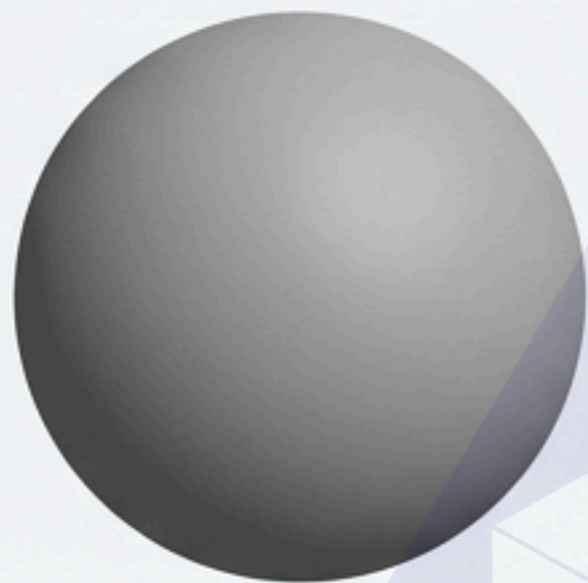
UNIT 2.2

Atomic Models

How the discovery of sub-atomic particles forced a scientific revolution.



Dalton's Assumption



Atoms were believed to be the ultimate, uncuttable, and fundamental building blocks of matter.

$- e^{-}$

$+ p^{+}$

$\bullet n^0$

Cathode ray discharge tubes and radioactivity proved the atom has internal pieces.

The Sub-atomic Reality



Atoms are highly structured composites of charged sub-atomic particles.



The Paradigm Shift

If the atom has internal parts, how are they arranged to form stable matter?





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$$E=mc^2$$



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Core Questions Scientists Needed to Answer



Account for Stability

Why don't the negatively charged electrons and positively charged protons collapse into each other?



Compare Element Behavior

How do we explain the rich diversity of physical and chemical properties across different elements?



Explain Molecular Bonding

How do different atoms combine to form completely new molecules?



Understand Electromagnetic Spectra

What is the origin and nature of the specific electromagnetic radiation absorbed or emitted by atoms?

From Thomson to Rutherford to Bohr

Thomson (1898)



The Breakthrough

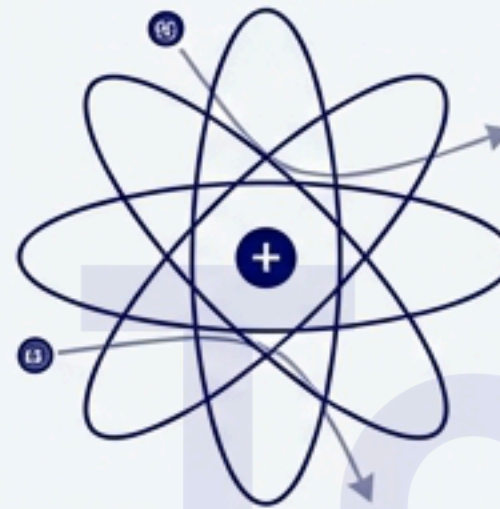
Accounts for overall electrical neutrality.



Fatal Flaw

Fails to explain the α -particle scattering experiment; mass is not uniformly distributed.

Rutherford (1911)



The Breakthrough

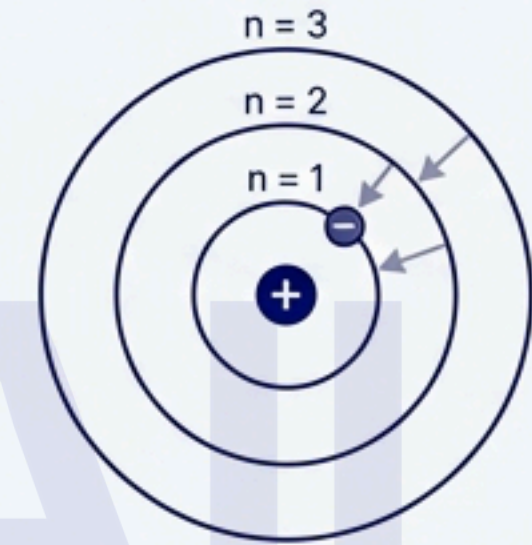
Discovers the dense, positive nucleus; proves the atom is mostly empty space.



Fatal Flaw

Fails Maxwell's theory. Accelerating electrons would spiral into the nucleus in 10^{-8} s. Fails to explain line spectra.

Bohr (1913)



The Breakthrough

Quantized angular momentum ($m_e v r = n(h/2\pi)$). Perfectly explains the Hydrogen line spectrum.

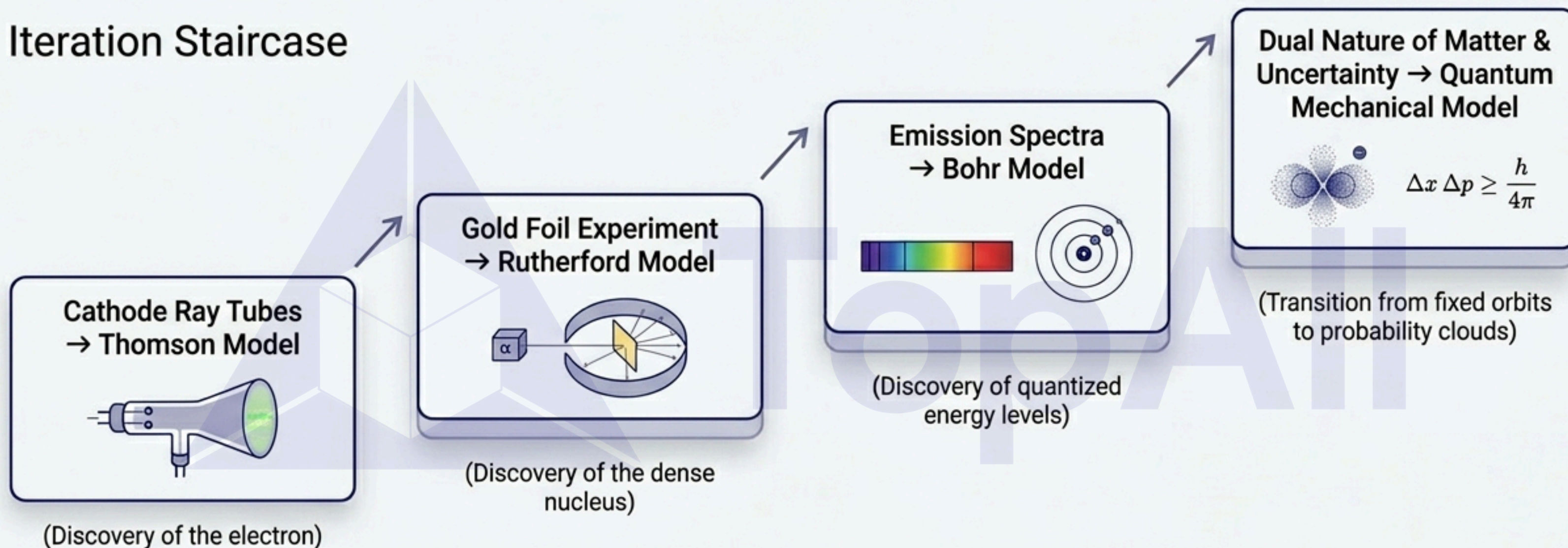


Fatal Flaw

Fails for multi-electron atoms. Violates Heisenberg's Uncertainty Principle ($\Delta x \Delta p \geq h/4\pi$).

Final Recap: Atomic models evolve with evidence.

Iteration Staircase



Atomic models are never truly “finished”—they continually evolve as our capacity to gather empirical evidence improves.



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