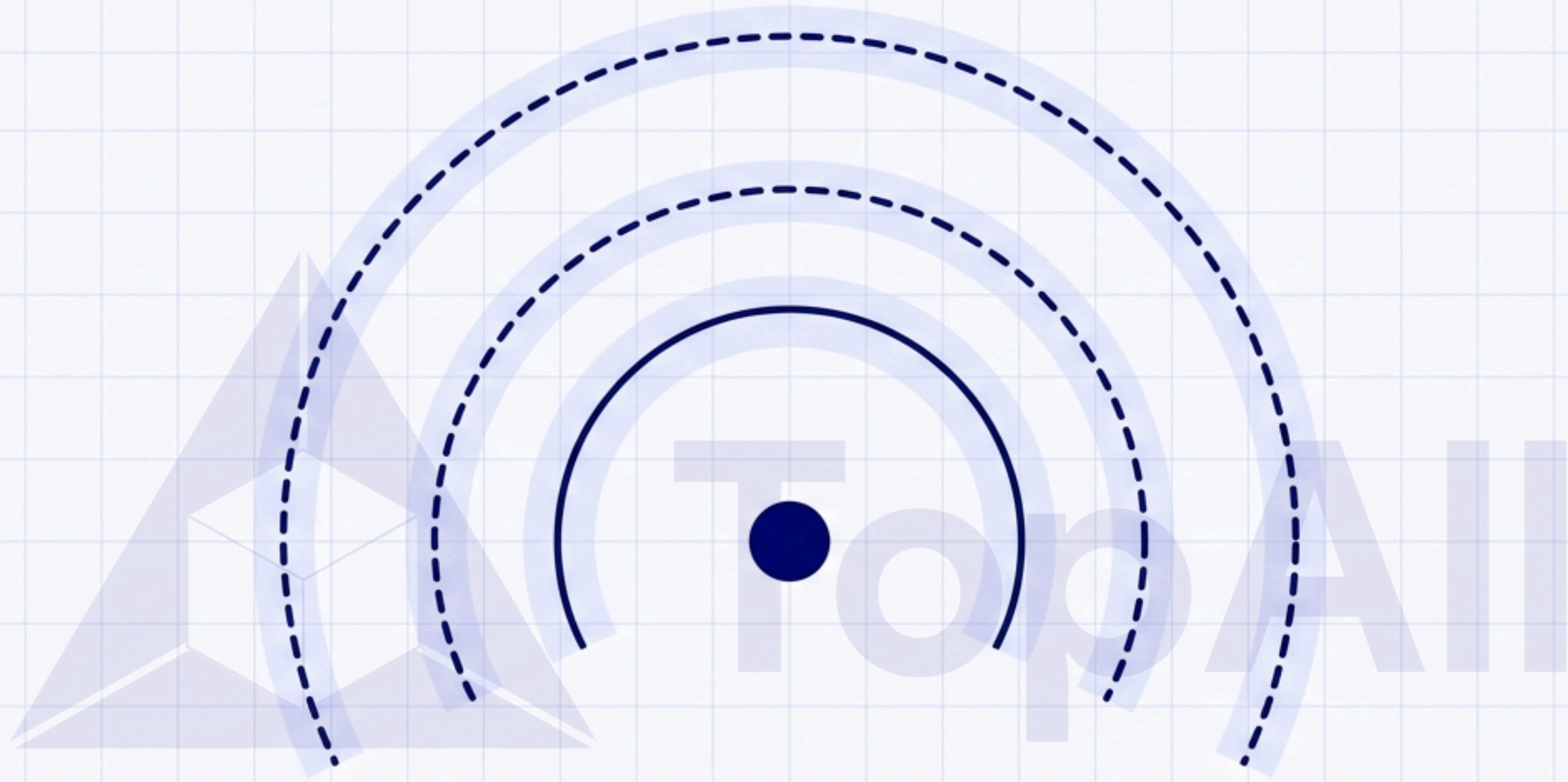
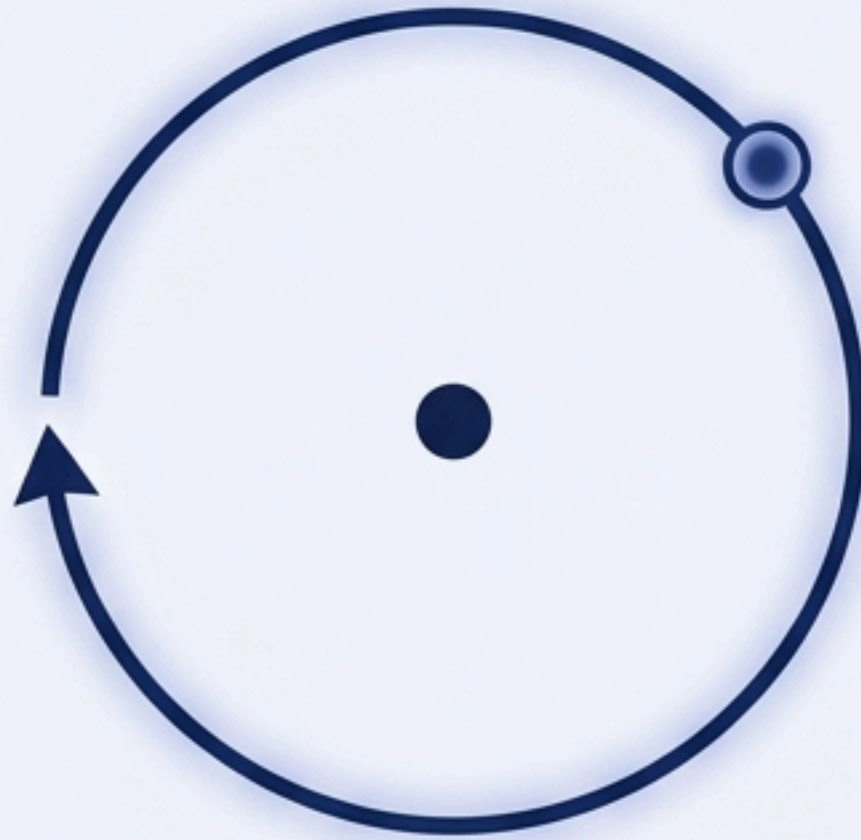




Bohr Model of Hydrogen

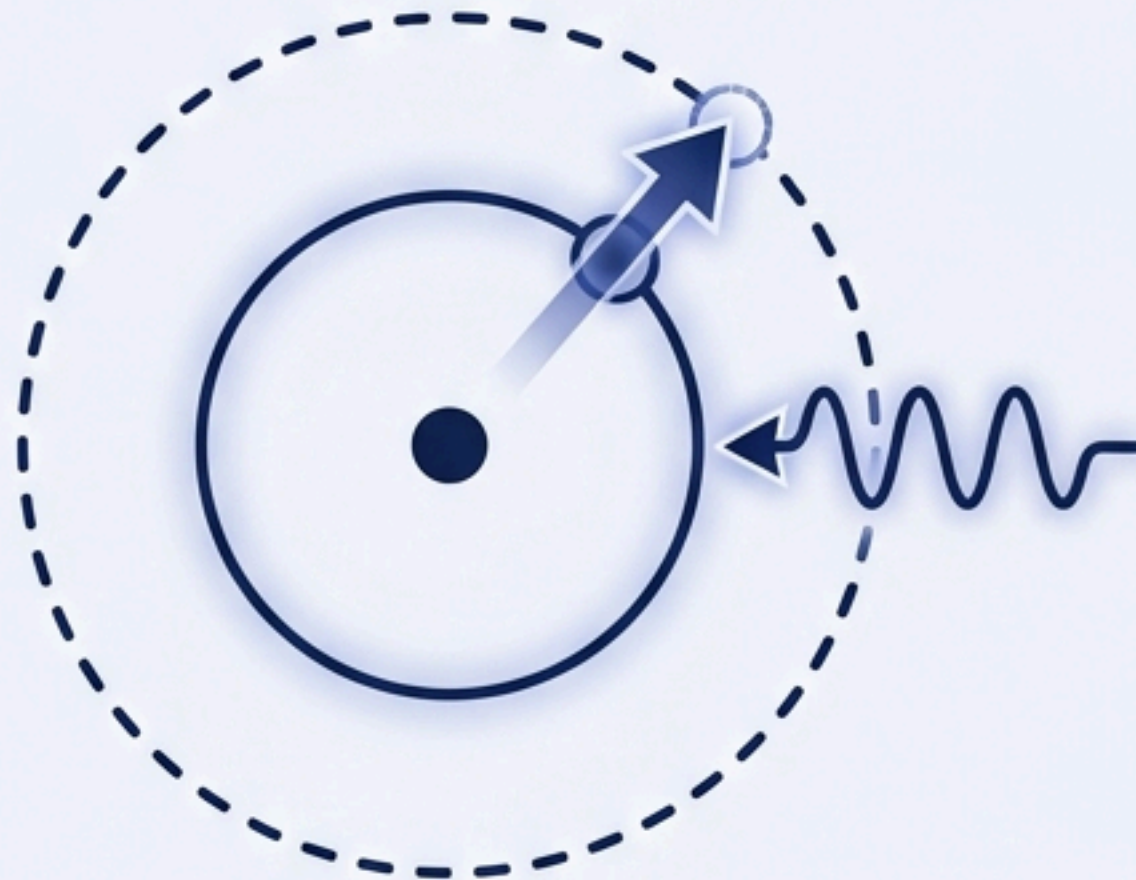
Quantization of the Atom – Postulates, Mathematics, and Spectra.

Fixed radius and energy orbits.



Stationary State: No Energy Loss.

Energy changes only during transition.



Transition State: Energy Exchanged.

$$m_e v r = n \left(\frac{h}{2\pi} \right)$$

m_e : Mass of the electron

electron

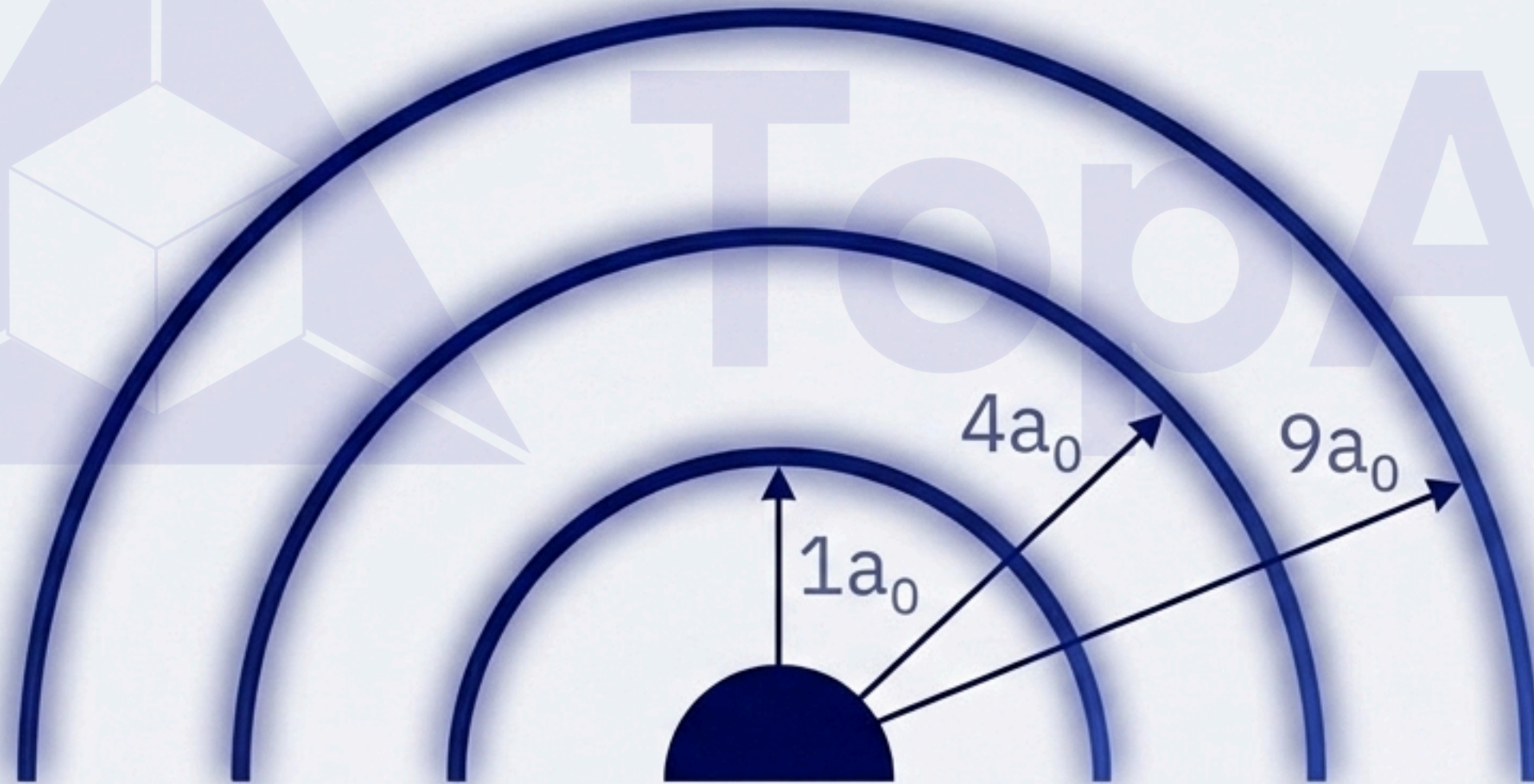
v : Velocity

r : Radius

n : The Principal Quantum Number
(Integer: 1, 2, 3... —
Never continuous fractions)

$$r_n = n^2 a_0$$

$a_0 = 52.9 \text{ pm}$ (Bohr radius)



Orbital spacing is non-linear; it scales quadratically.



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$$E=mc^2$$



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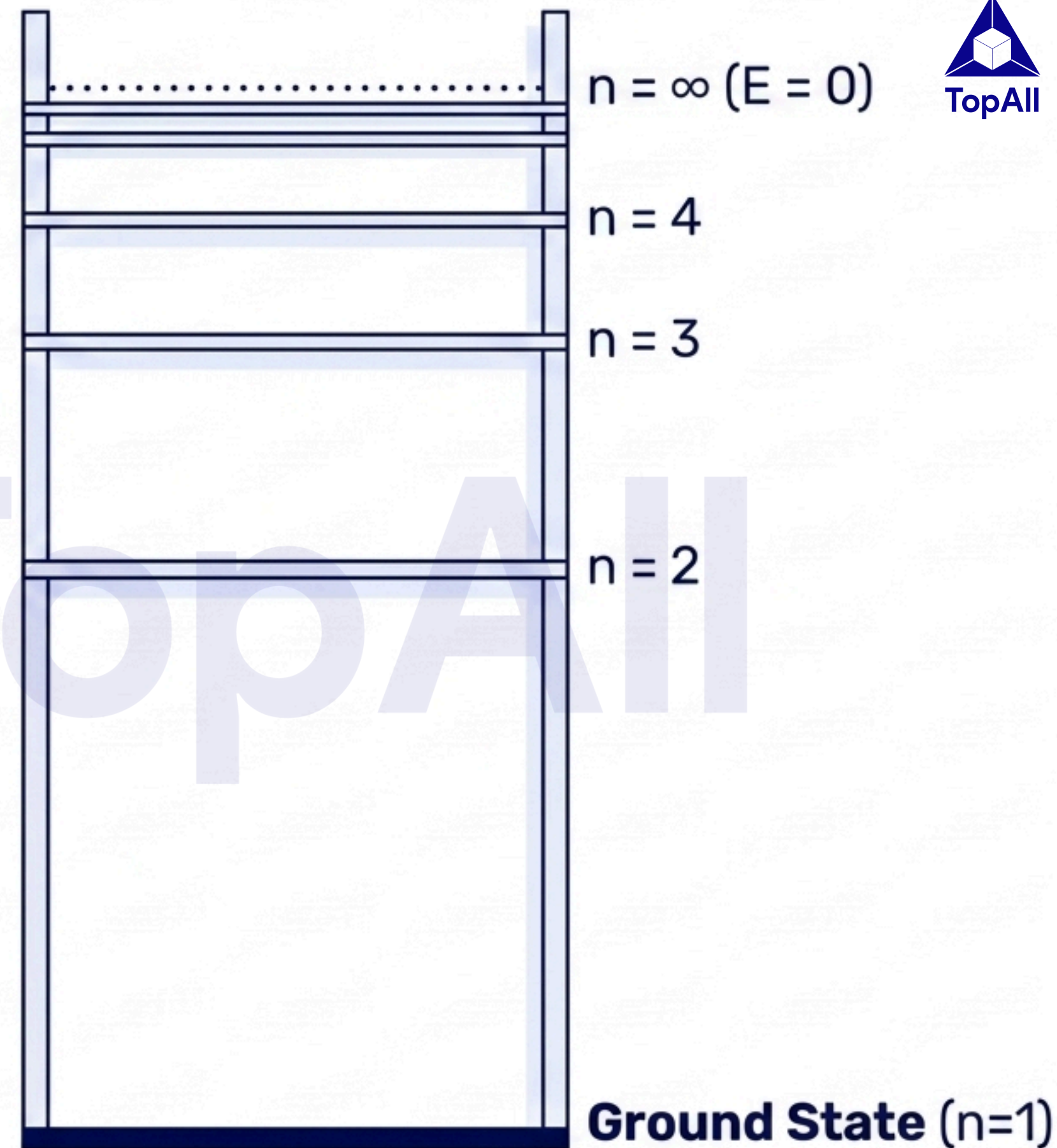


$$E_n = -R_H \frac{1}{n^2}$$

$R_H = 2.18 \times 10^{-18} \text{ J}$ (Rydberg constant)



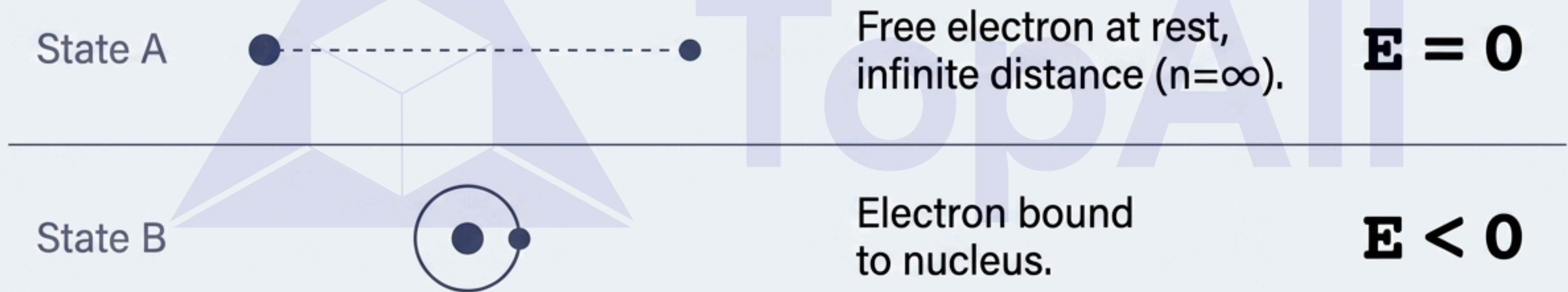
Energy gaps shrink as principal quantum number increases.



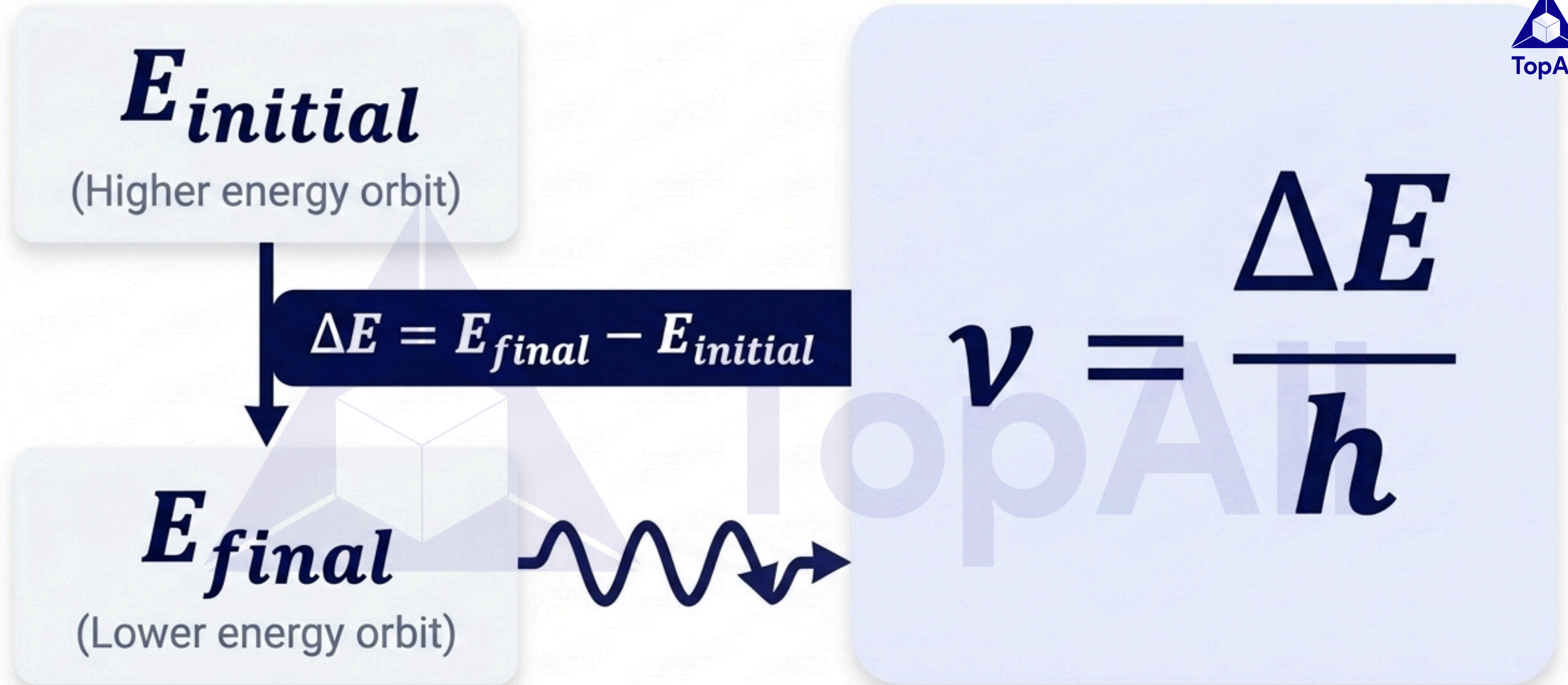


The Negative Energy Trap

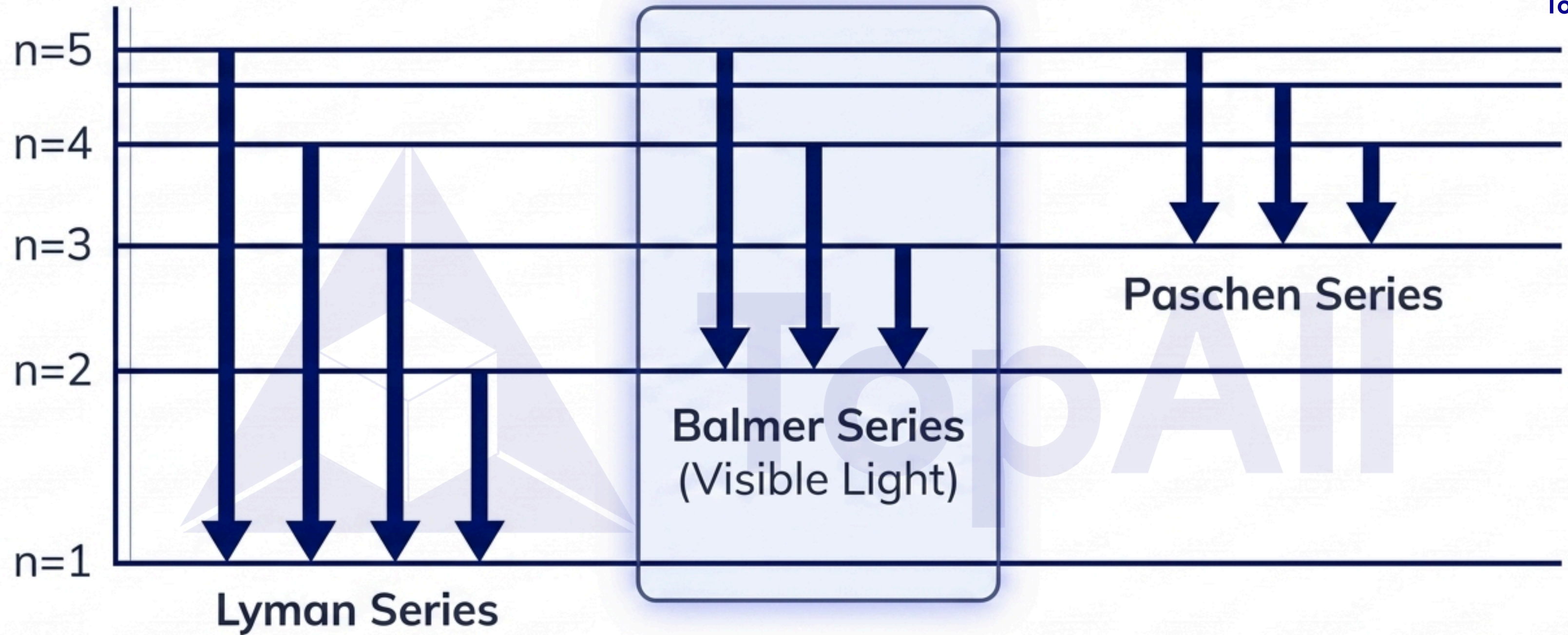
Negative energy does NOT mean “less than zero existence”—it signifies a bound, stable electron.



The negative sign dictates that the electron is physically more stable (in a lower energy state) than when it is free. It owes energy to the nucleus.



Bohr's Equation for Light – Energy difference directly dictates the frequency (ν) of the emitted photon.



Quantized mathematical steps perfectly predict the observable, discrete lines of the hydrogen emission spectrum.

Key Takeaways



Explains Stability

The quantization of angular momentum creates stationary states, overriding classical mechanics and preventing the electron from spiraling into the nucleus.



Explains Spectra

Energy transitions perfectly map to the discrete line spectrum of hydrogen, bridging the gap between thermodynamic math and visible light.



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