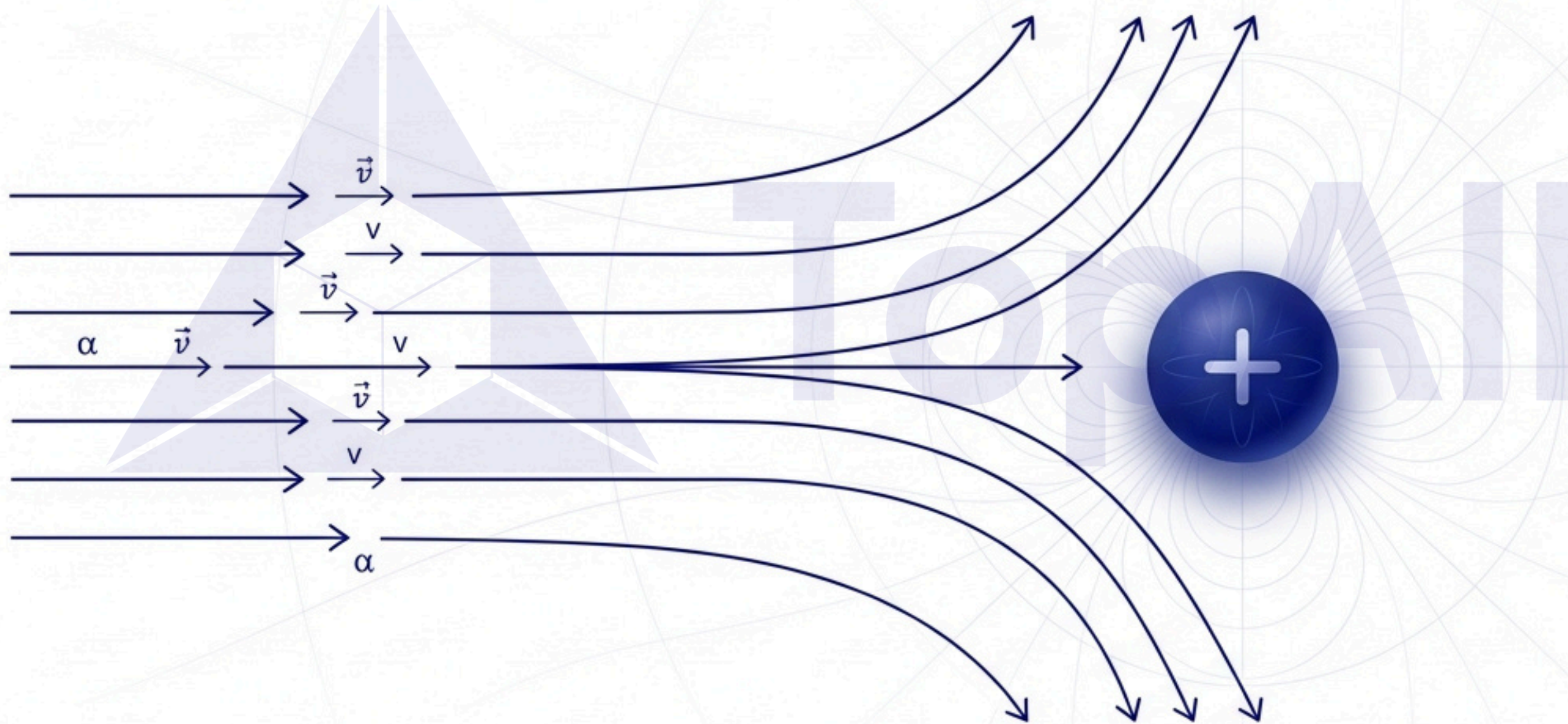


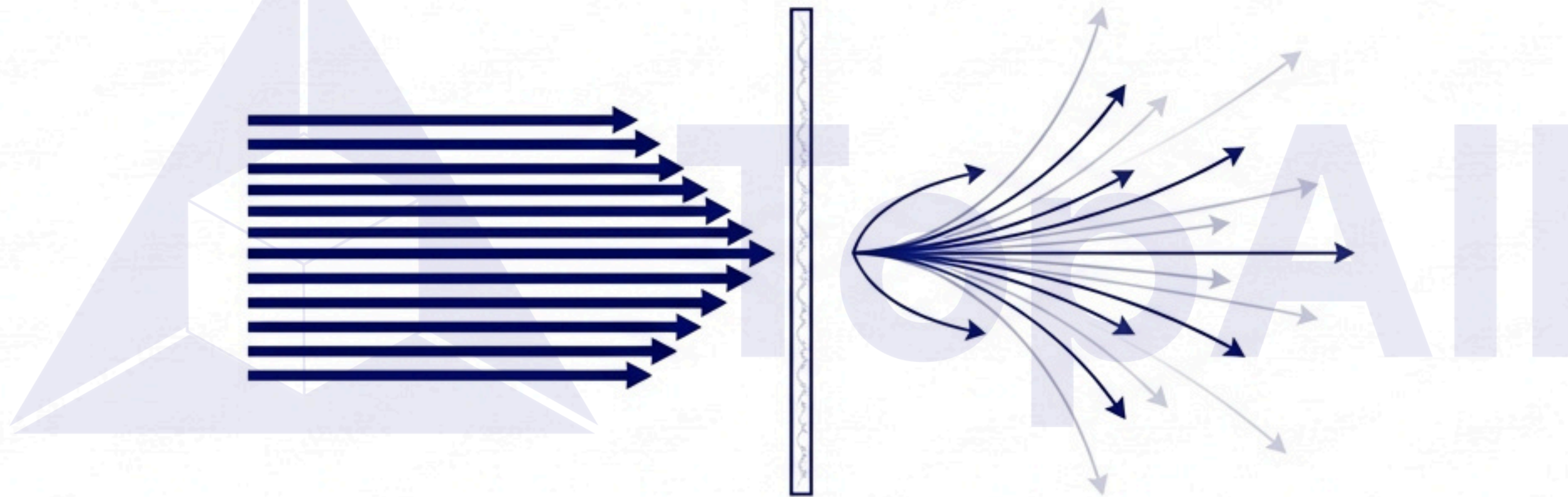
Alpha-particle Trajectory

Why some particles bend slightly while others rebound



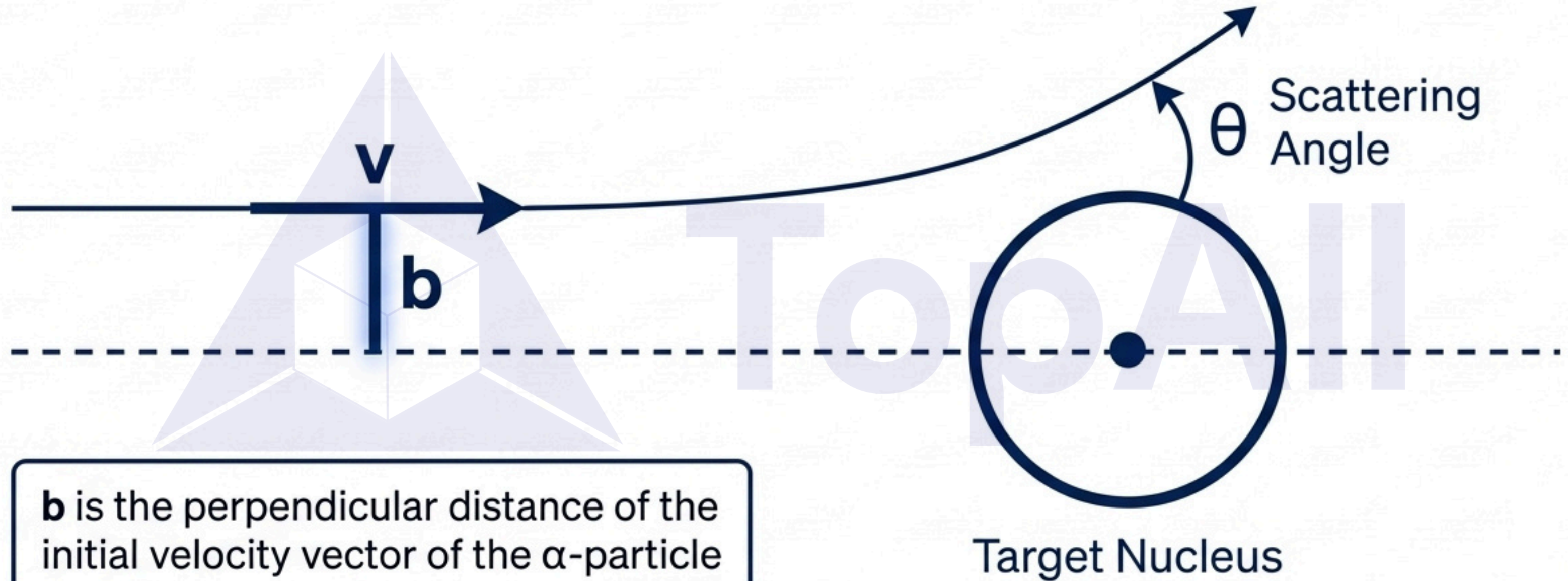
Why do all α -particles not scatter in the same way?

In a given beam, all α -particles have nearly the same kinetic energy. Yet, they scatter in vastly different directions with different probabilities.



The answer lies in a single geometric variable.

Defining the Impact Parameter (b)



b is the perpendicular distance of the initial velocity vector of the α -particle from the centre of the nucleus.



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$$E=mc^2$$



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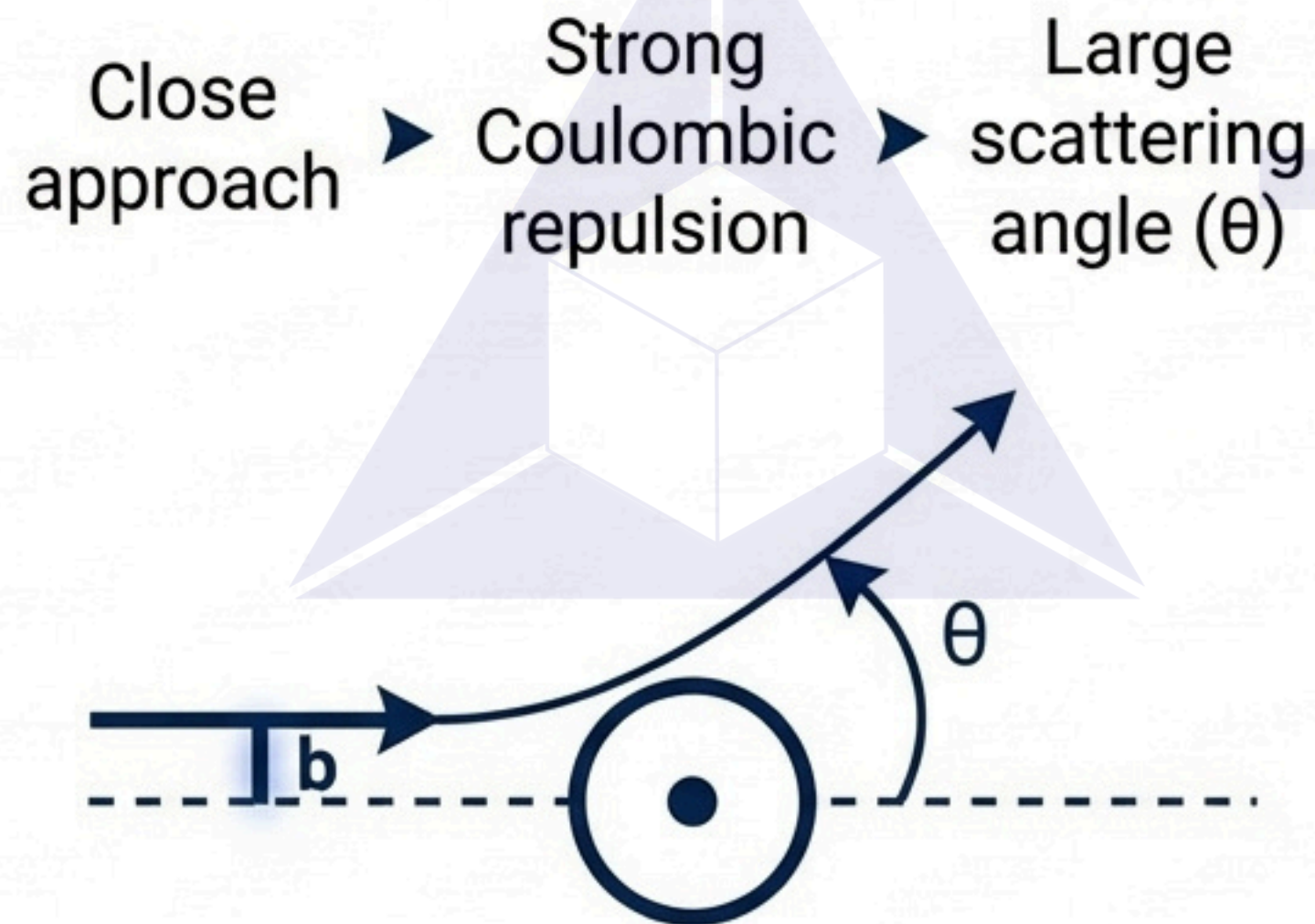
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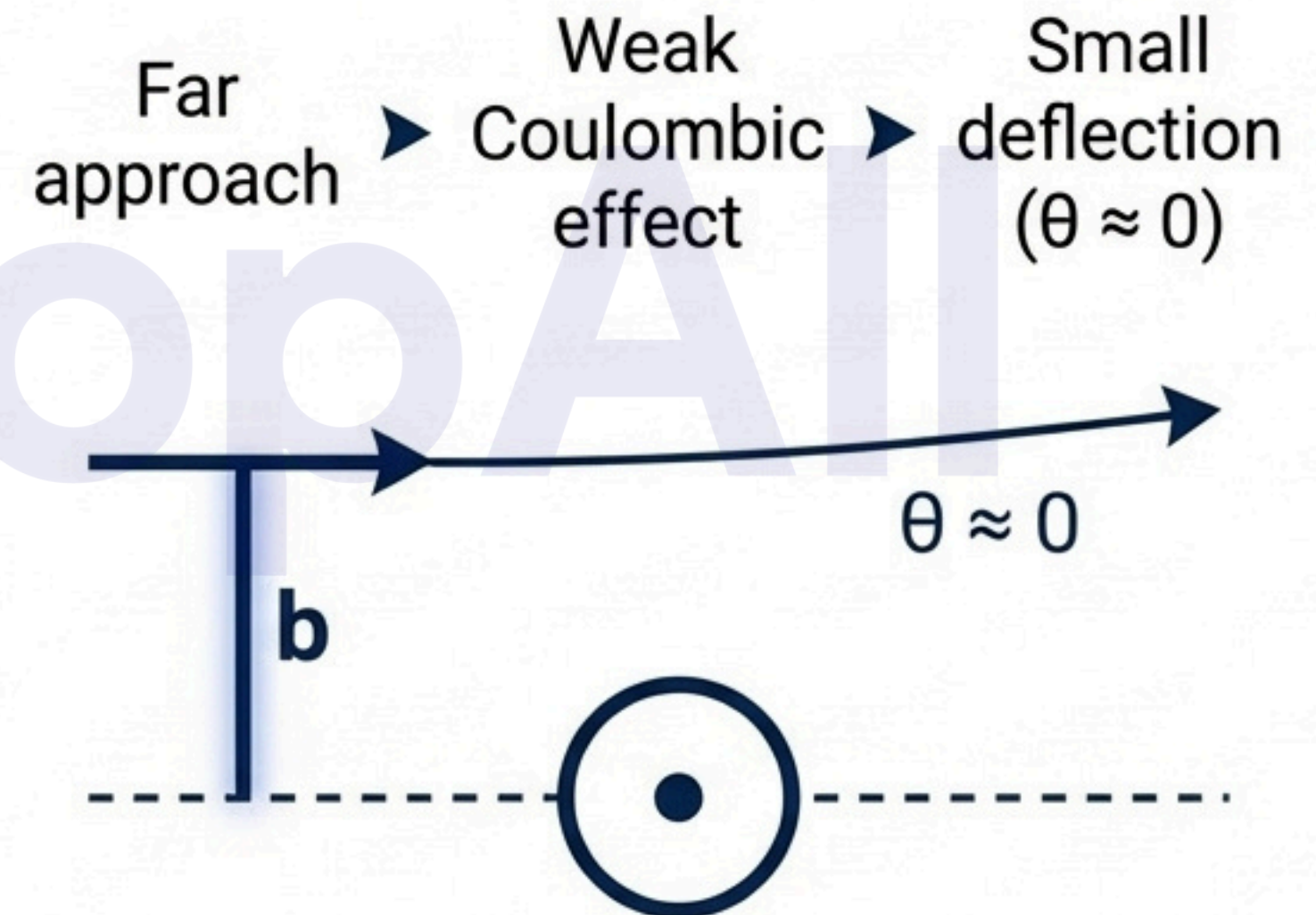


Small b vs. Large b

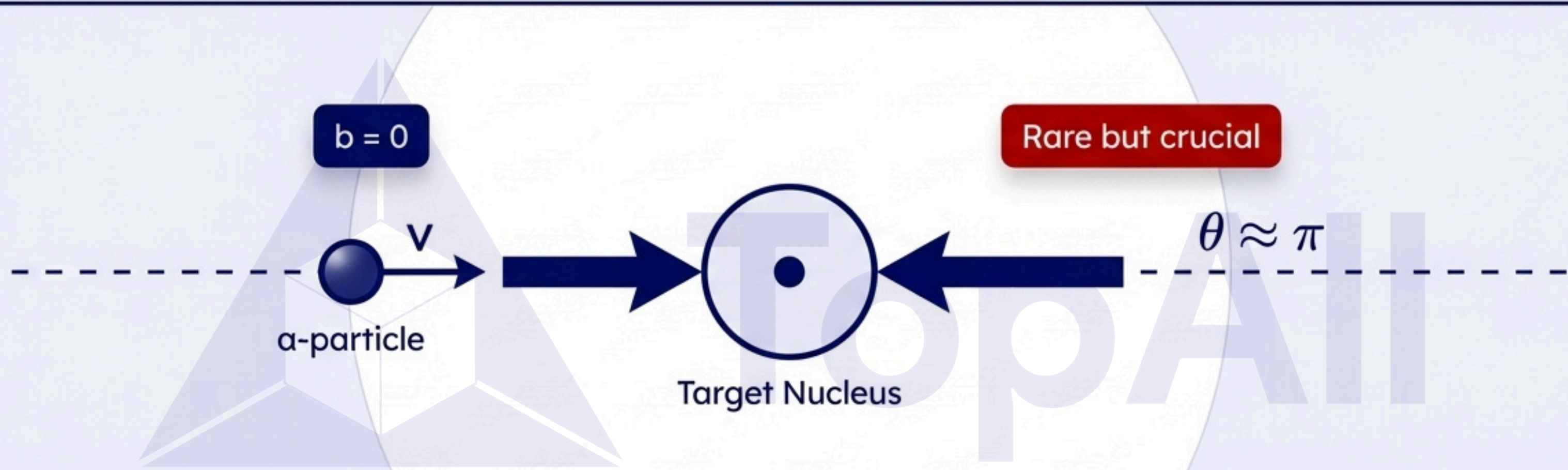
Small Impact Parameter



Large Impact Parameter



The Head-On Collision



In a head-on approach, the impact parameter is minimum. The incoming particle faces the strongest possible electrostatic force of repulsion, causing it to rebound completely.



Core Principle

Smaller impact parameter (b) means a larger scattering angle (θ).

⚠ Common Mistake / Exam Trap

Do not assume many particles experience strong deflection. Because most of the atom is empty space, head-on collisions ($b=0$) are extraordinarily rare.

Only about 1 in 8000 particles deflect by more than 90° .
The nucleus is 10,000 to 100,000 times smaller than the atom itself.



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