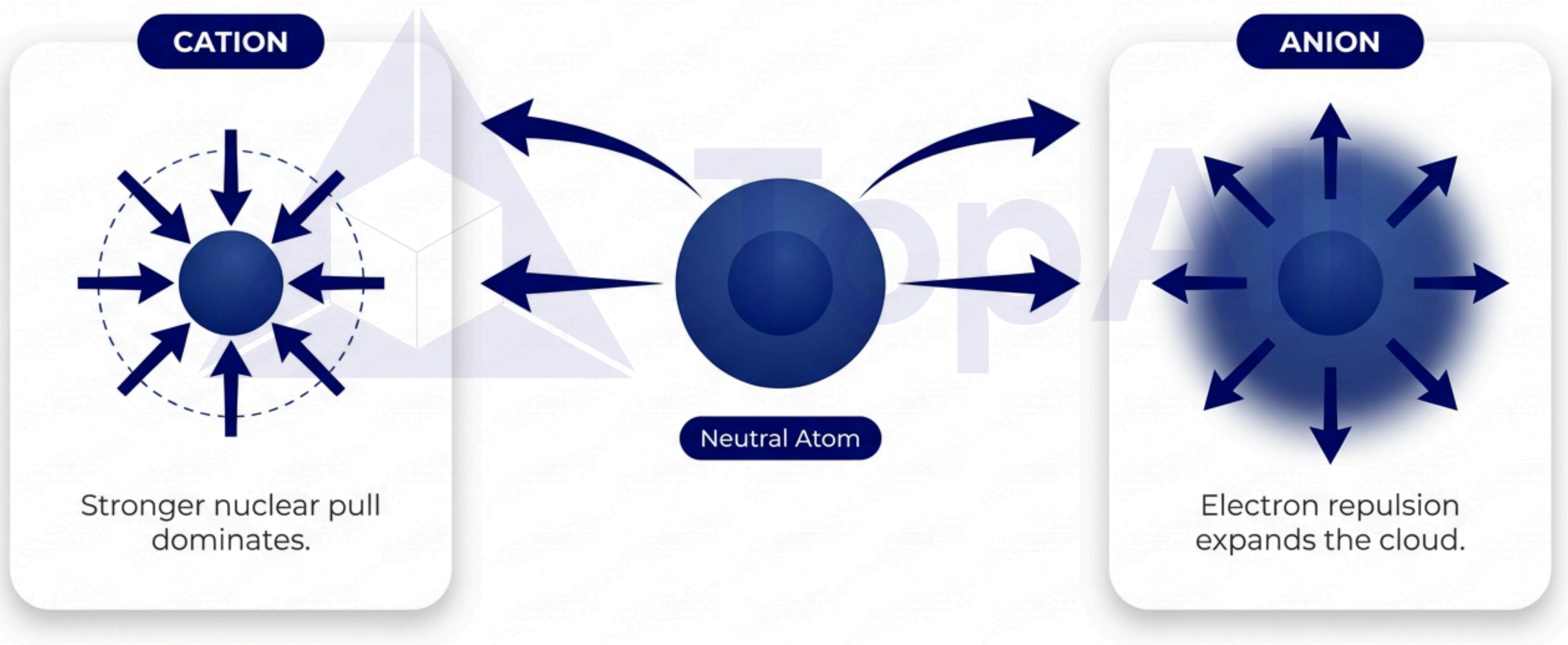


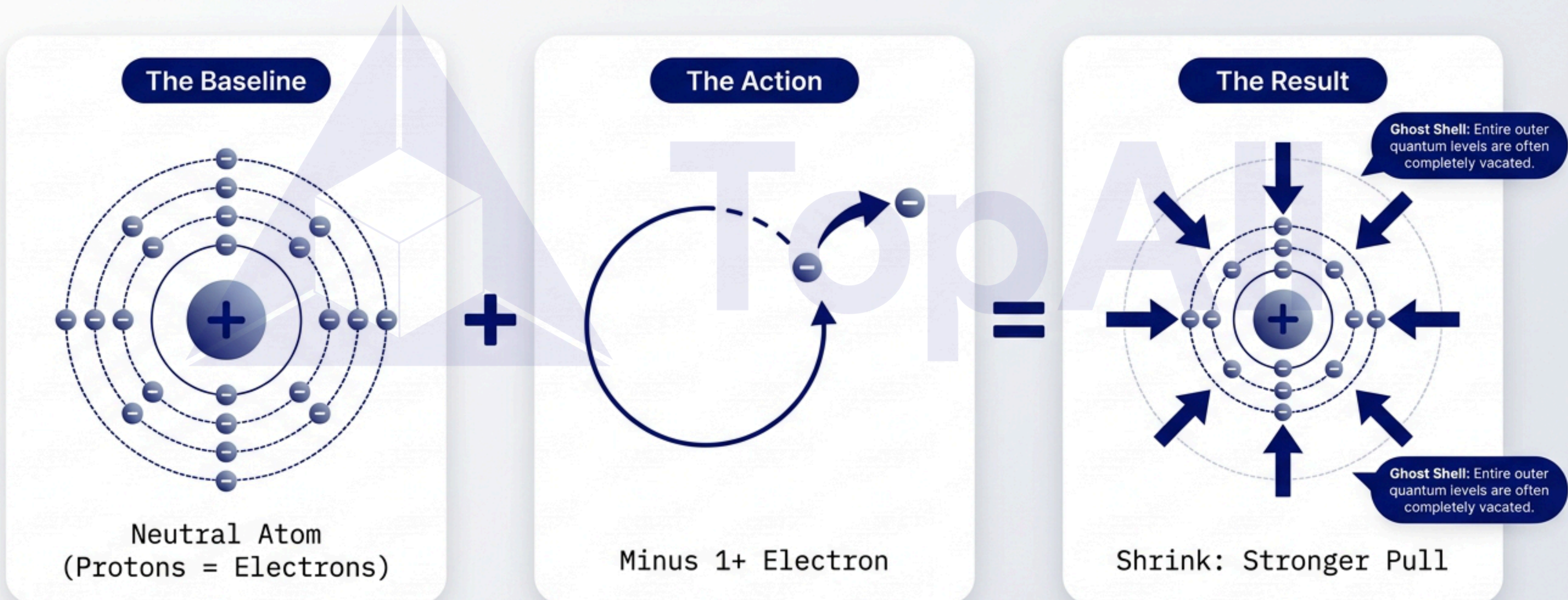
Cations Shrink, Anions Expand

The Electrostatic Tug-of-War in Ionic Radii



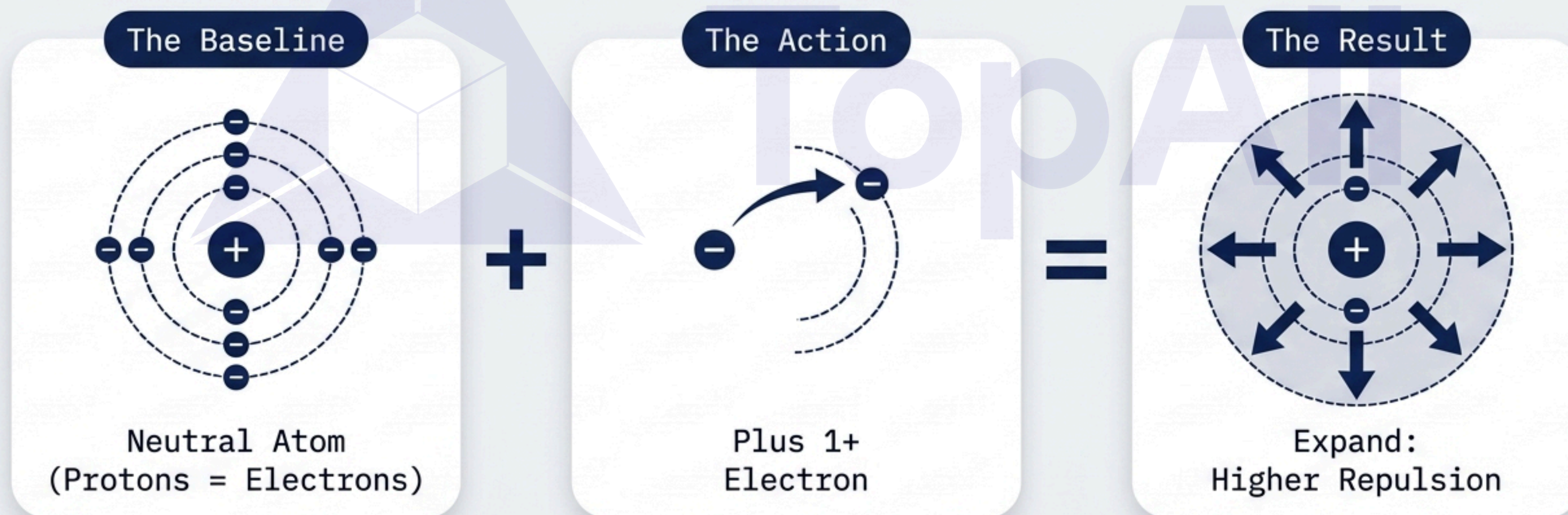
Cation Formation: The Inward Pull

When an electron is lost, the nuclear charge remains identical, but the shielding effect drops. The nucleus exerts a stronger inward pull on the remaining electrons.



Anion Formation: The Outward Push

Adding electrons without adding protons tips the balance of power. **Extra electrons crowd the valence shell, increasing repulsion and expanding the cloud.**





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$$E=mc^2$$



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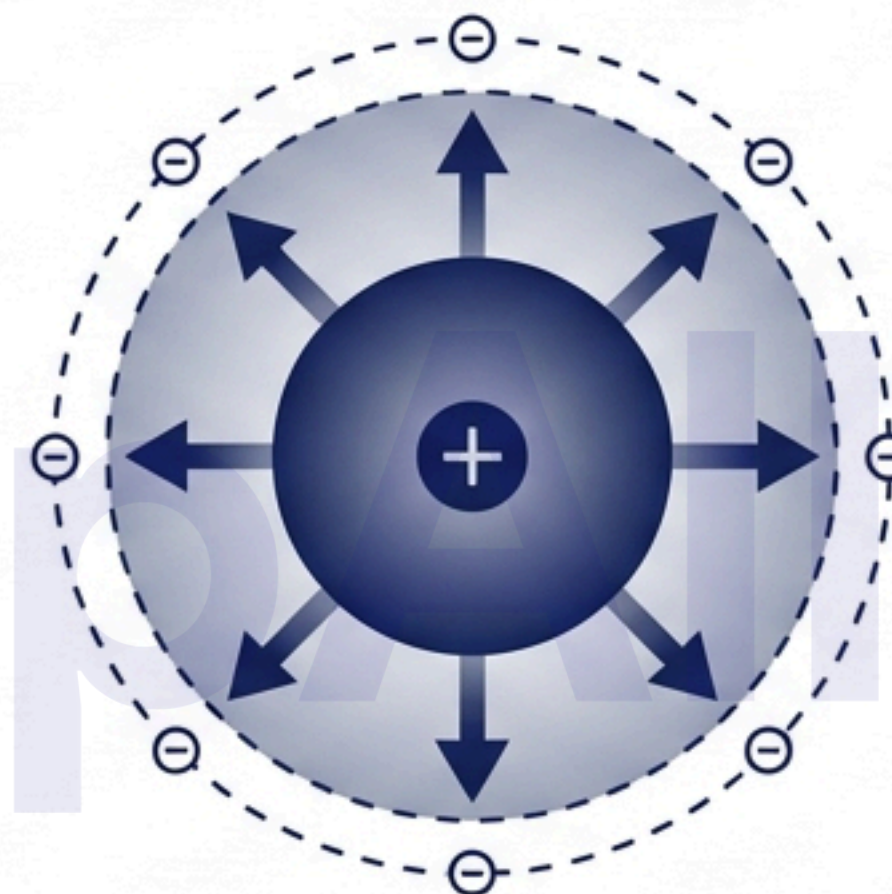
The Anion Scale: Fluorine Expansion

F (Neutral)



64 pm

F⁻ (Fluoride Ion)

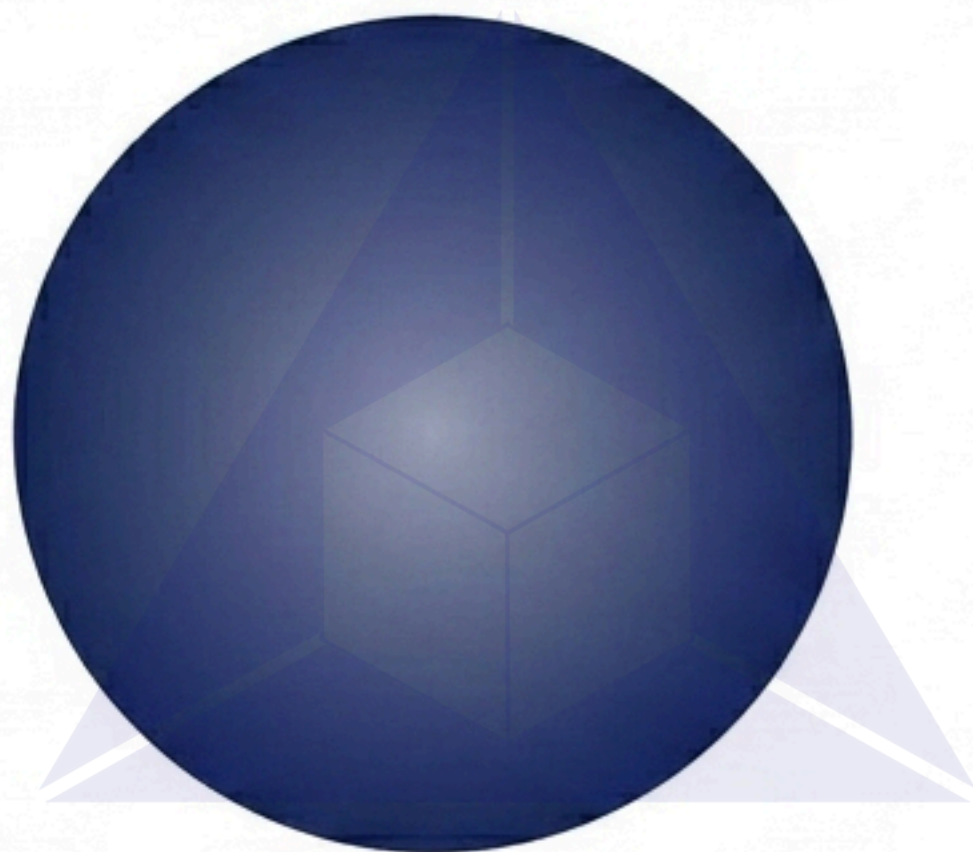


136 pm

Data Proof: Fluoride's radius more than doubles due to the addition of just one single electron.

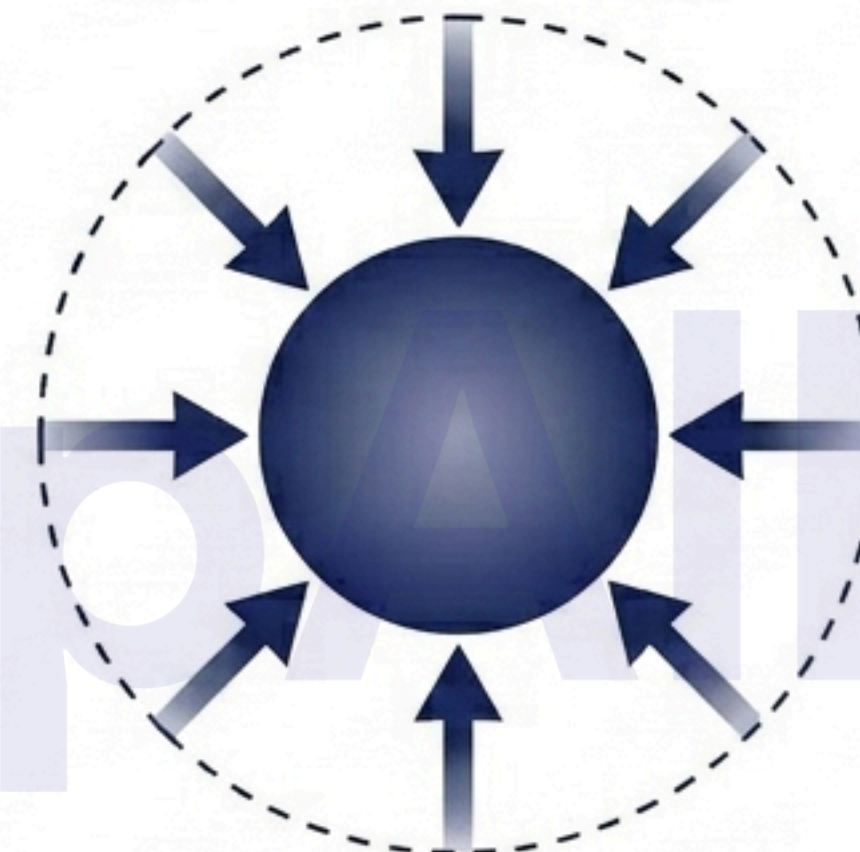
The Cation Scale: Sodium Contraction

Na (Neutral)



186 pm

Na⁺ (Sodium Ion)

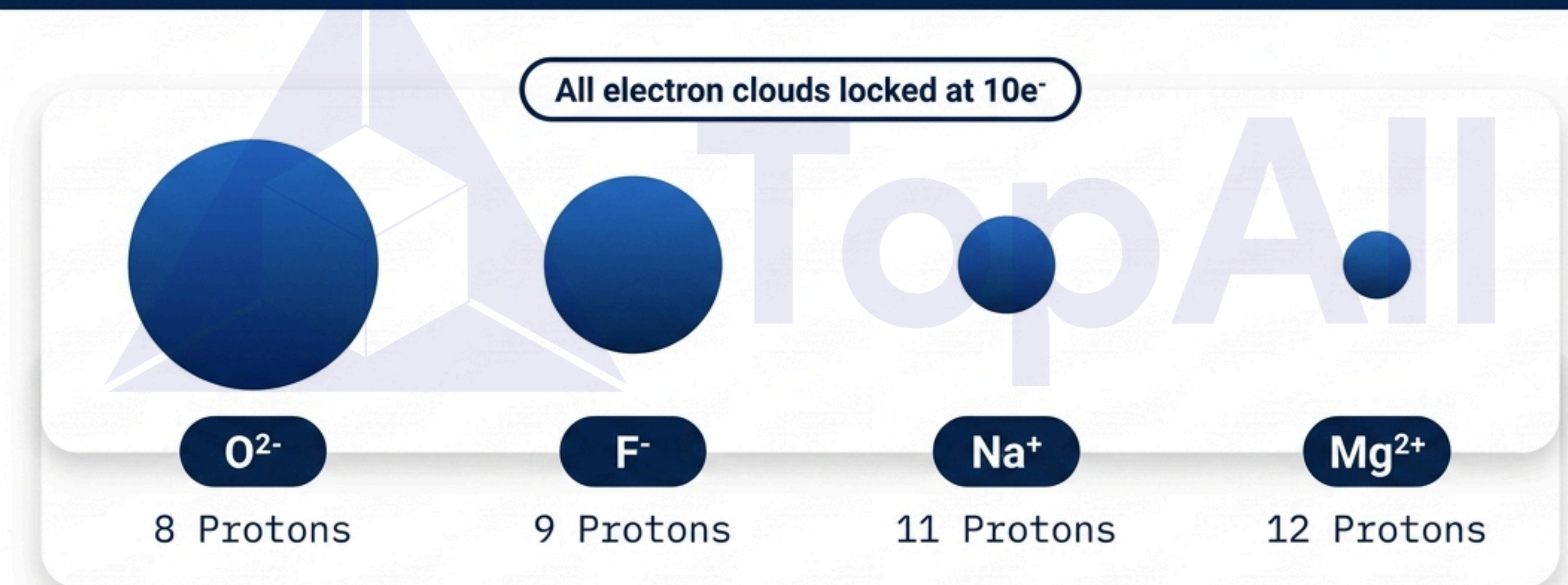


95 pm

Data Proof: Sodium sheds nearly 50% of its radius by vacating an entire energy shell.

The Isoelectronic Spectrum

Isoelectronic Species: Atoms and ions containing the exact same number of electrons.



When electron repulsion is **identical** (fixed at $10e^-$), the nucleus becomes the ultimate tiebreaker. More protons = a tighter, smaller radius.

The Exam-Hacker Shortcut

Same Electrons + Higher Nuclear Charge = Smaller Radius

The Tiebreaker Rule

ALERT

When evaluating isoelectronic species, the nucleus is the deciding factor. The greater the positive charge (more protons), the smaller the radius. The greater the negative charge, the larger the radius.

Never look at proton counts first.
Always calculate the total electron count to confirm the species are actually isoelectronic before you apply the tiebreaker rule.

Mastering the electrostatic tug-of-war unlocks accurate periodic predictions.



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