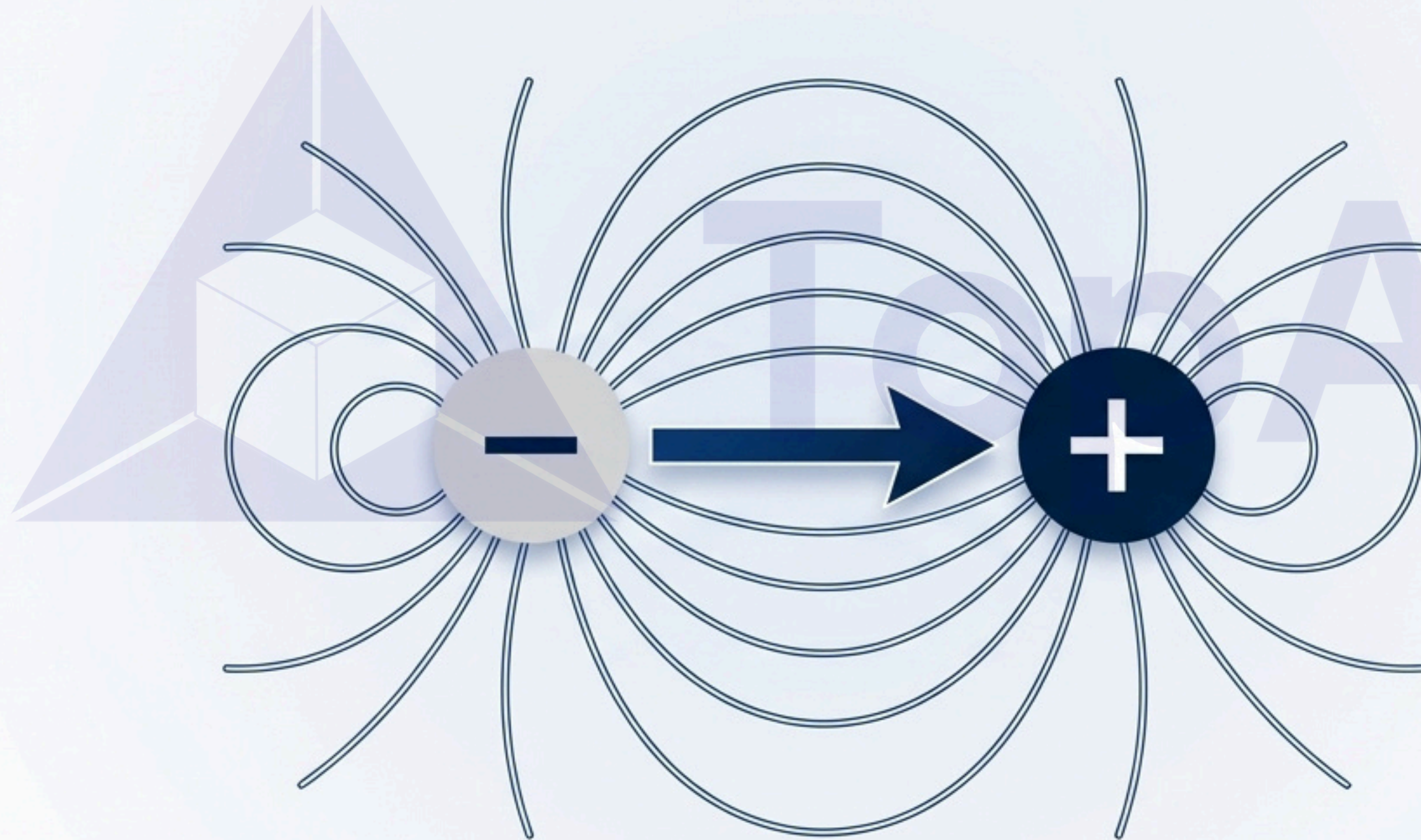


Electric Dipole

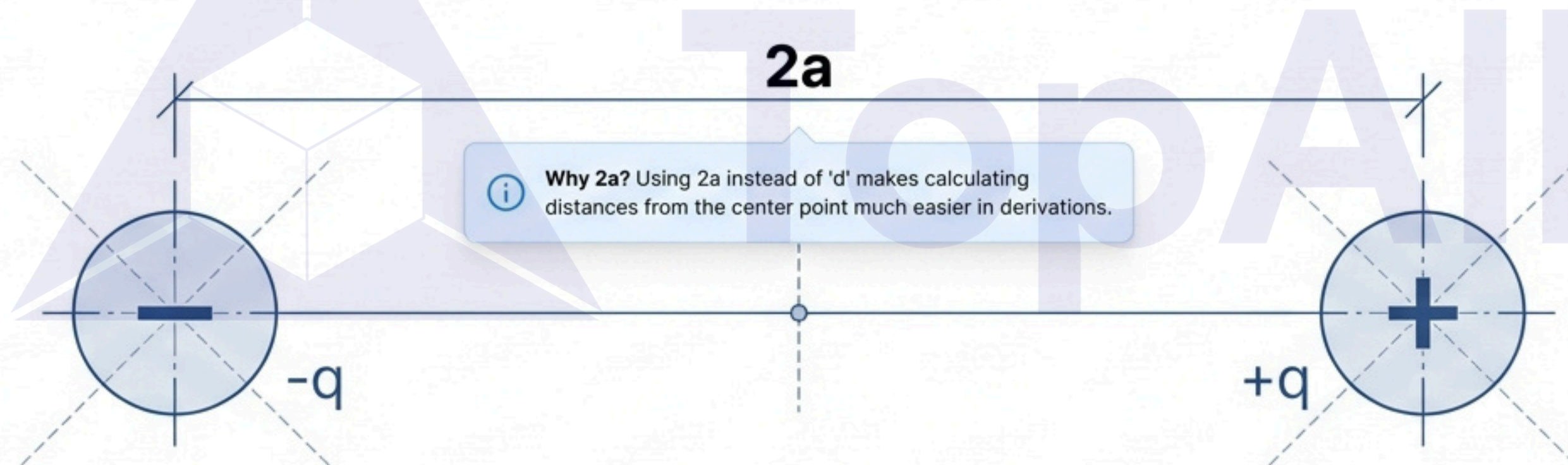
A zero-net-charge system with a powerful field pattern.



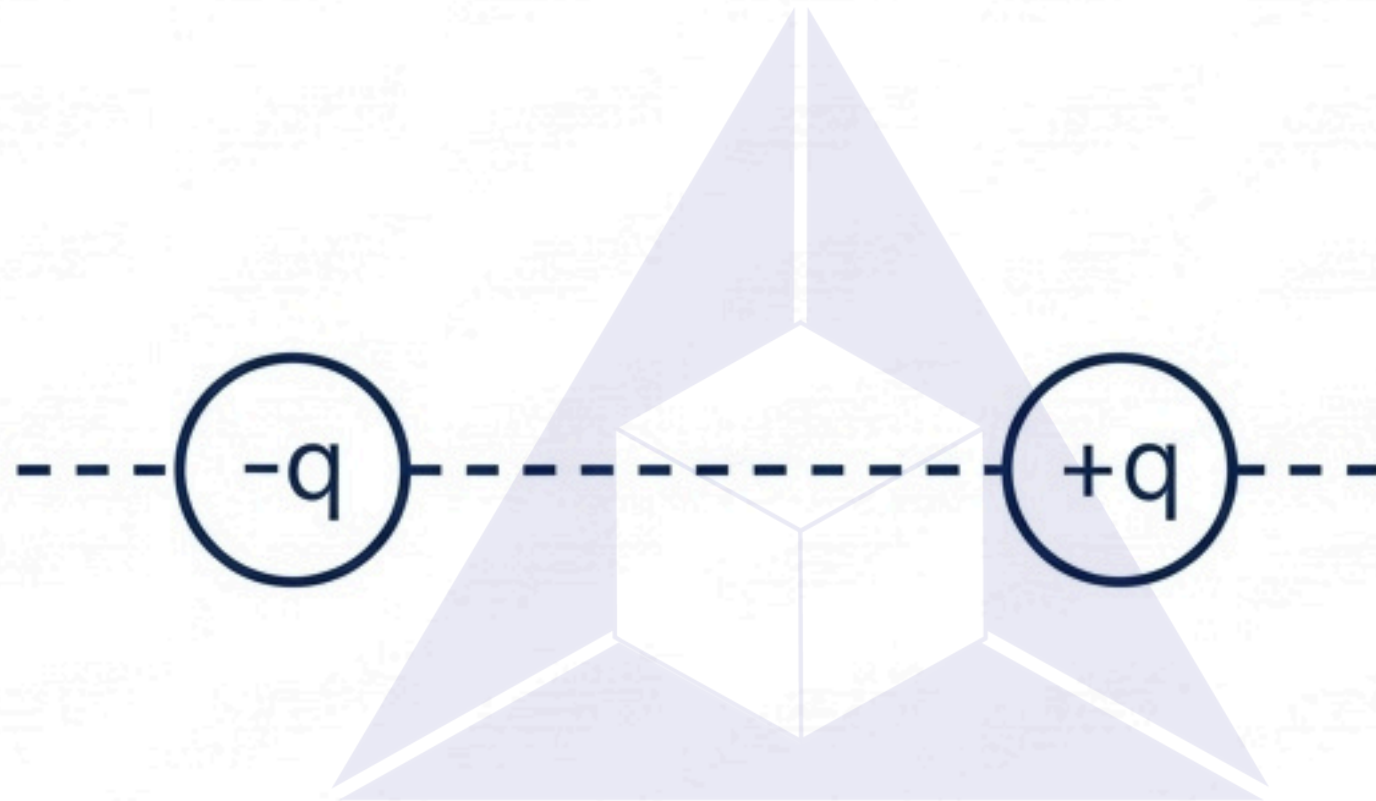
Swipe to begin →

H2: The Definition of an Electric Dipole

A pair of equal and opposite point charges separated by a fixed distance.

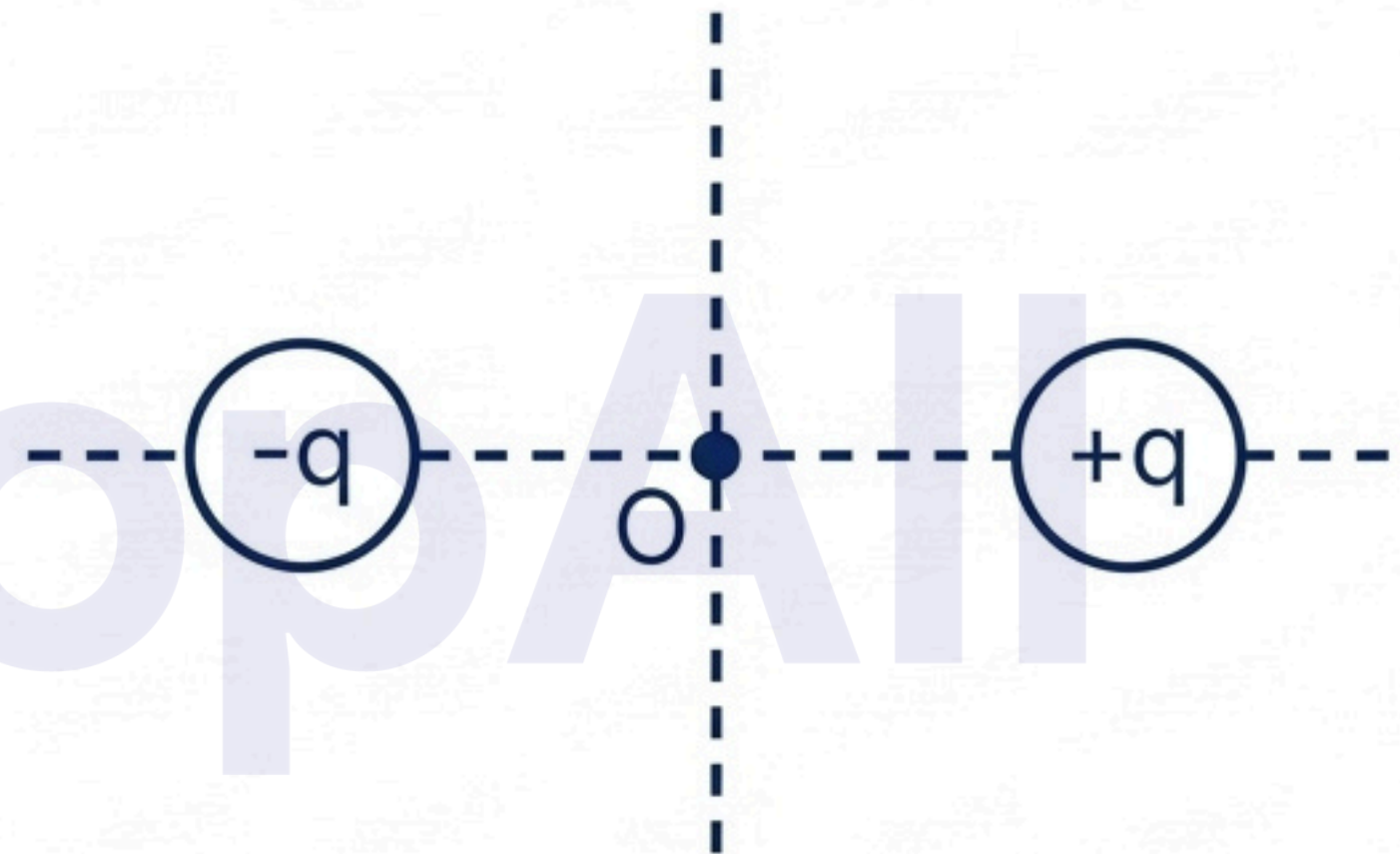


Dipole Axis



The **longitudinal line** passing directly through both charges.

Centre & Equatorial Plane



O is the **exact midpoint**. The plane passing through O and perpendicular to the axis is the equatorial plane.



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Electric Dipole Moment (p)

Formula Card

Dipole Moment Vector
(Unit: Coulomb-meter, C·m)

$$\mathbf{p} = q \times 2a$$

Vector separation
between charges

Magnitude of either charge
(ignoring the sign)

Exam Trap



Caution: Direction Mismatch

Unlike electric field lines which flow + to -, the dipole moment vector $\mathbf{p}$ ALWAYS points from -q to +q.

H2: Why Net Charge Zero $\neq$ Zero Field



Total charge is exactly zero. But because the charges are physically separated by $2a$, their individual fields at any distant point are mismatched.

Crucial Rule: The dipole field at large distances falls off as $1/r^3$, not $1/r^2$.
(It drops off much faster than a single point charge).



H3 Quick Recap

- ✓ Dipole = equal and opposite charges (q , $-q$) separated by $2a$.
- ✓ Net charge is **zero**, but net electric field is **NOT** zero.
- ✓ Dipole moment ($\mathbf{p}$) points strictly from Negative to Positive.

H3 Concept Check

What is the net charge of an H₂O molecule modeled as an electric dipole?

Zero. Dipoles are always electrically neutral overall.

Why does a dipole field drop off faster ($1/r^3$) than a point charge ($1/r^2$)?

Because the opposing fields of $+q$ and $-q$ nearly cancel each other out at large distances.

Next Module: Field of an Electric Dipole →



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