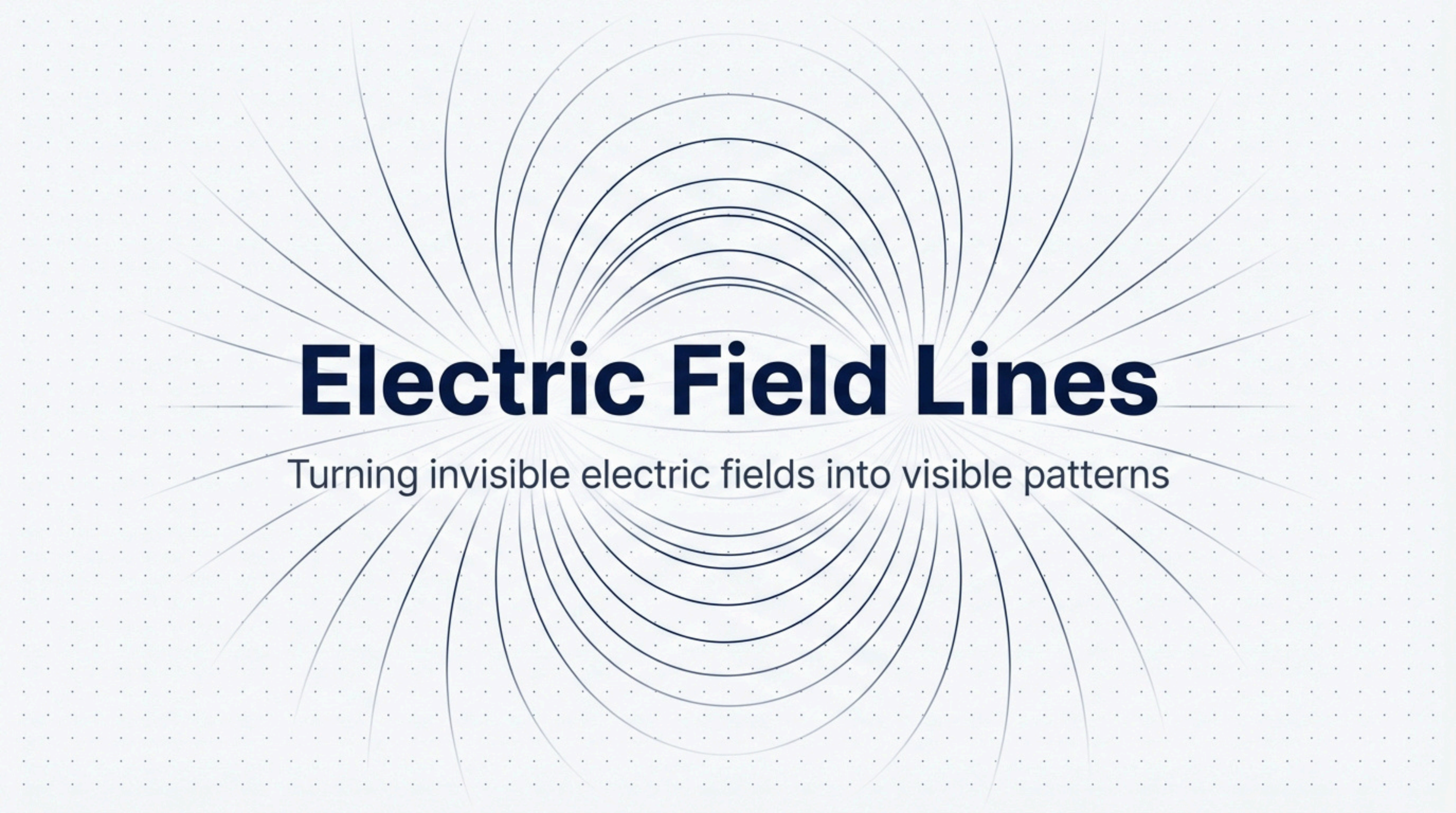


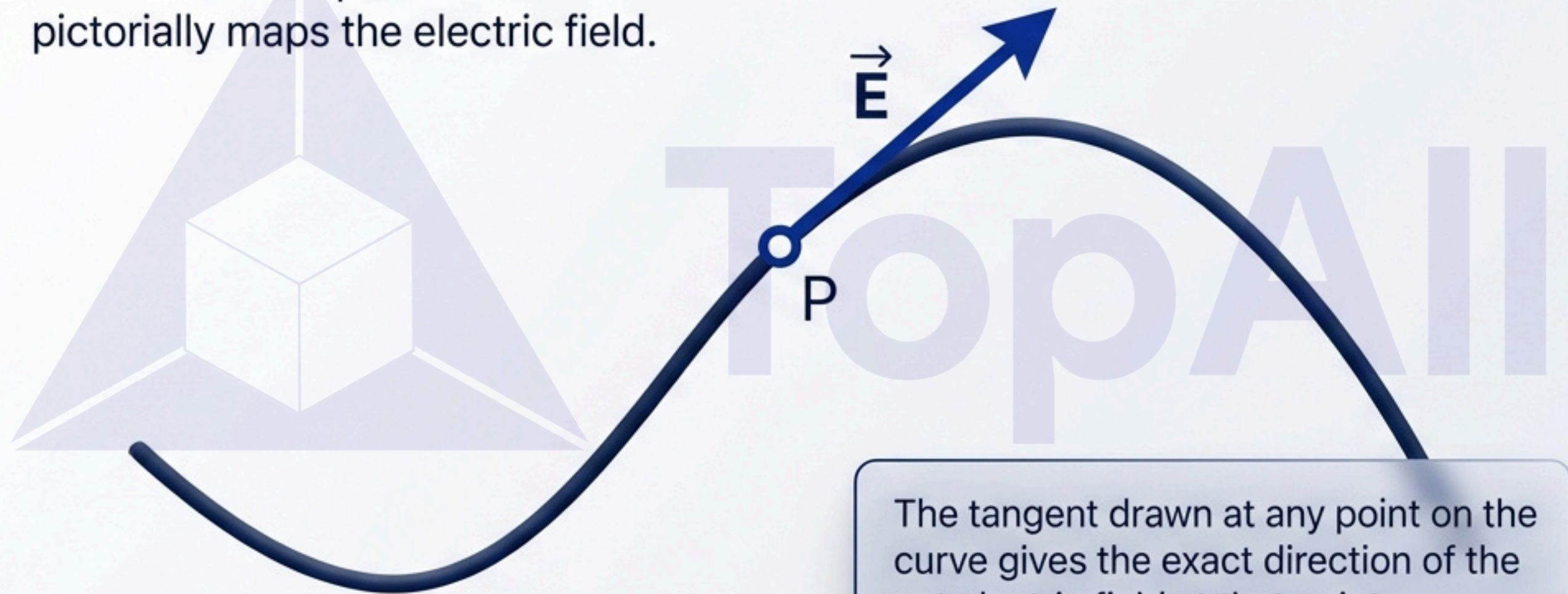
The background of the image features a light gray grid of small dots. Overlaid on this grid is a series of concentric, semi-transparent blue circles that radiate from the center. These circles represent the electric field lines of a point charge, with the spacing between them indicating the field's intensity.

Electric Field Lines

Turning invisible electric fields into visible patterns

What a Field Line Means

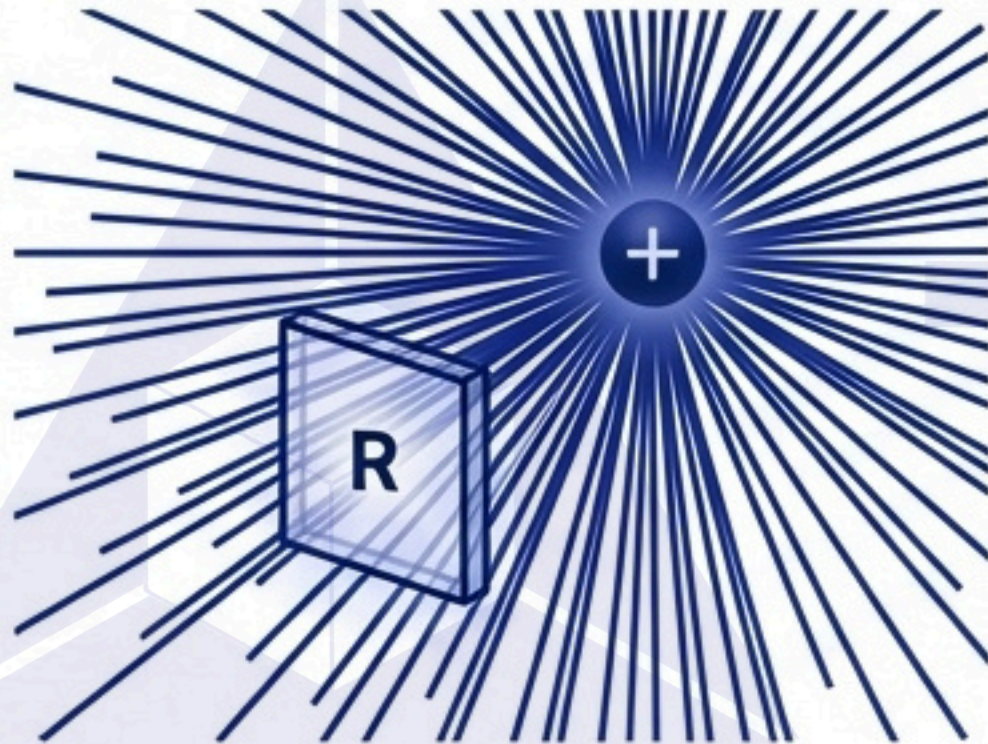
A field line is a space curve that pictorially maps the electric field.



The tangent drawn at any point on the curve gives the exact direction of the net electric field at that point.

Density of Lines = Field Strength

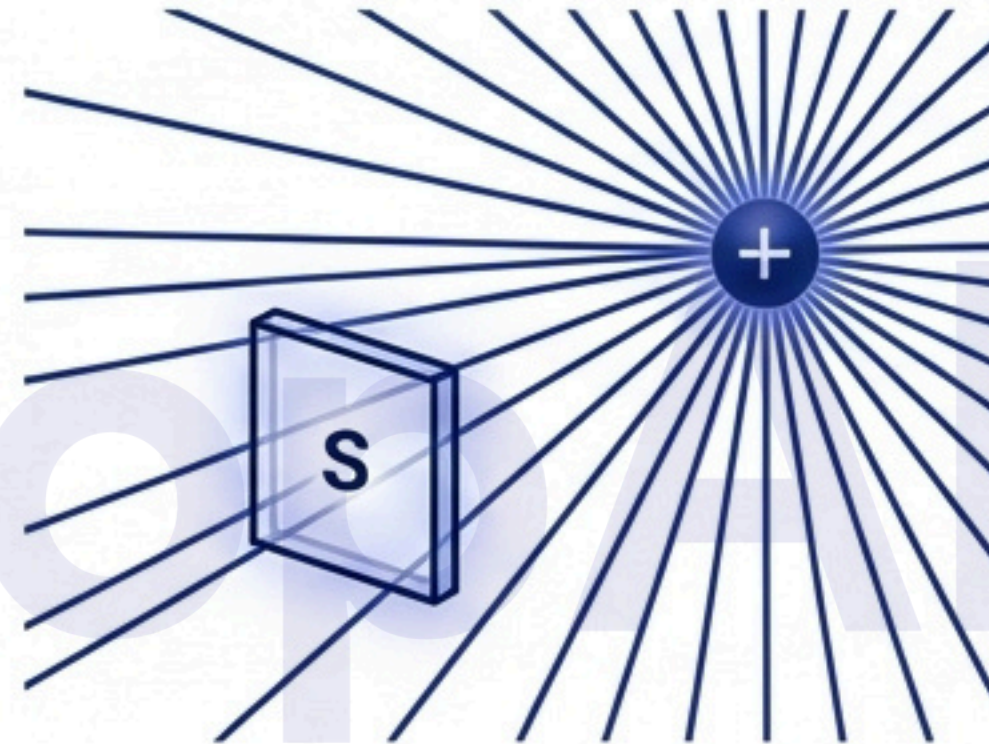
Strong Field



Crowded Lines

Indicates a stronger electric field (closer to the source charge).

Weak Field



Sparse Lines

Indicates a weaker electric field (further from the source charge).

The relative density of lines crossing a unit area is directly proportional to the electric field magnitude.



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$$E=mc^2$$



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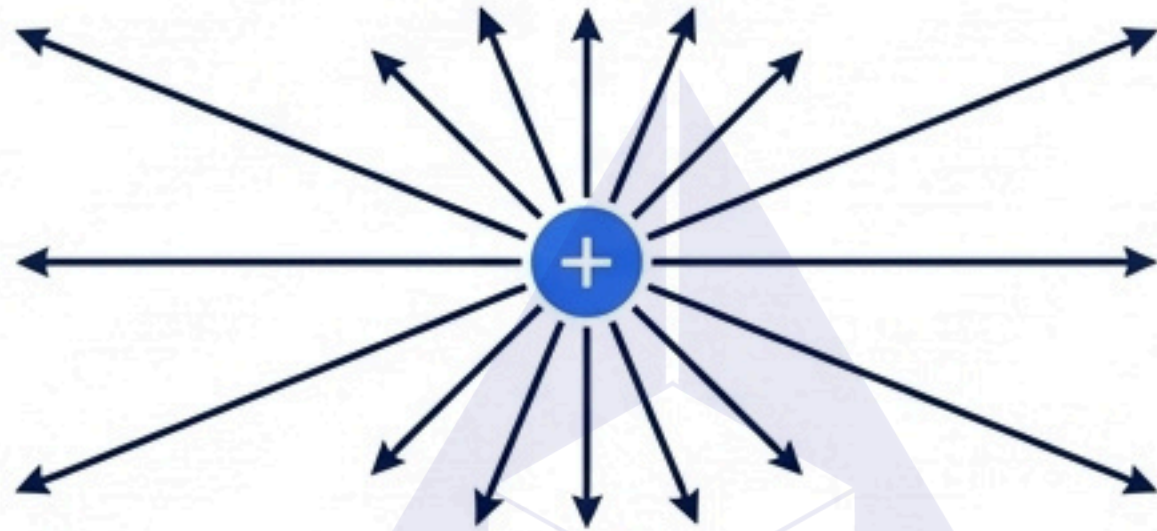
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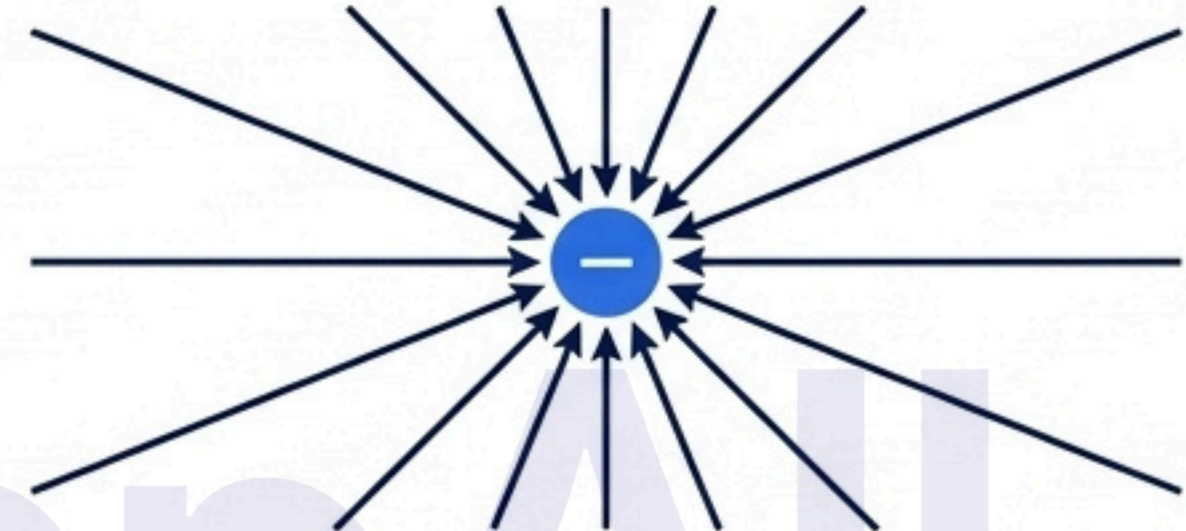


Standard Charge Configurations

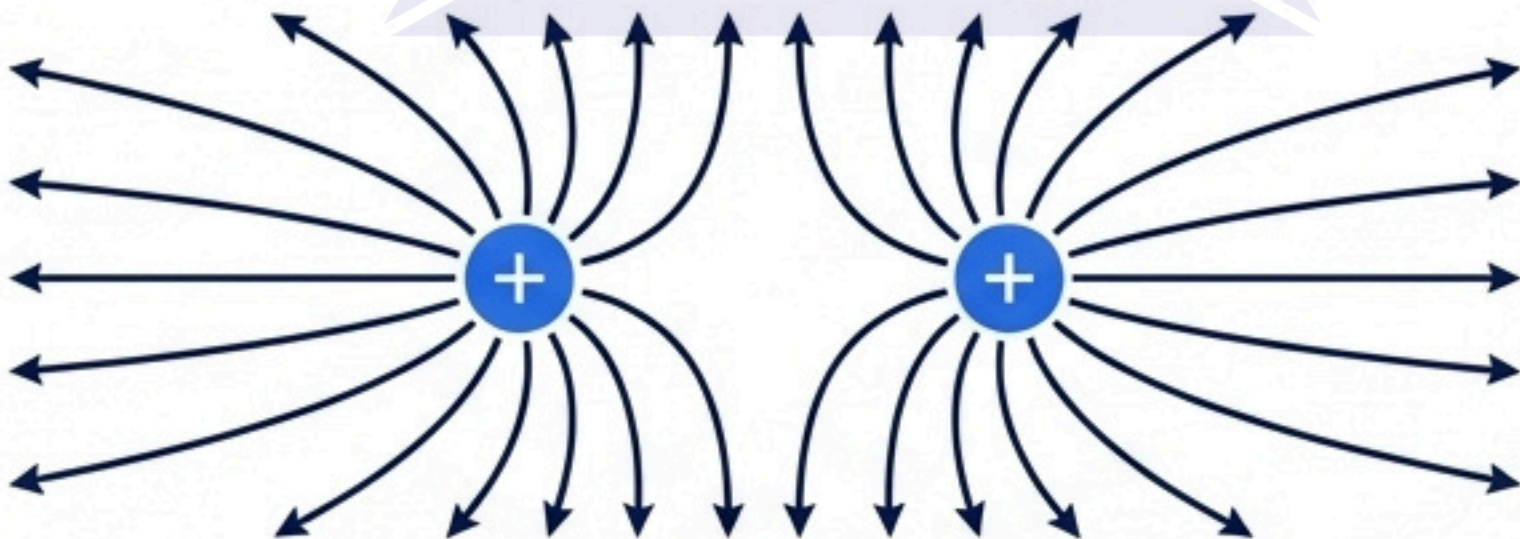
Single Positive ($q > 0$)



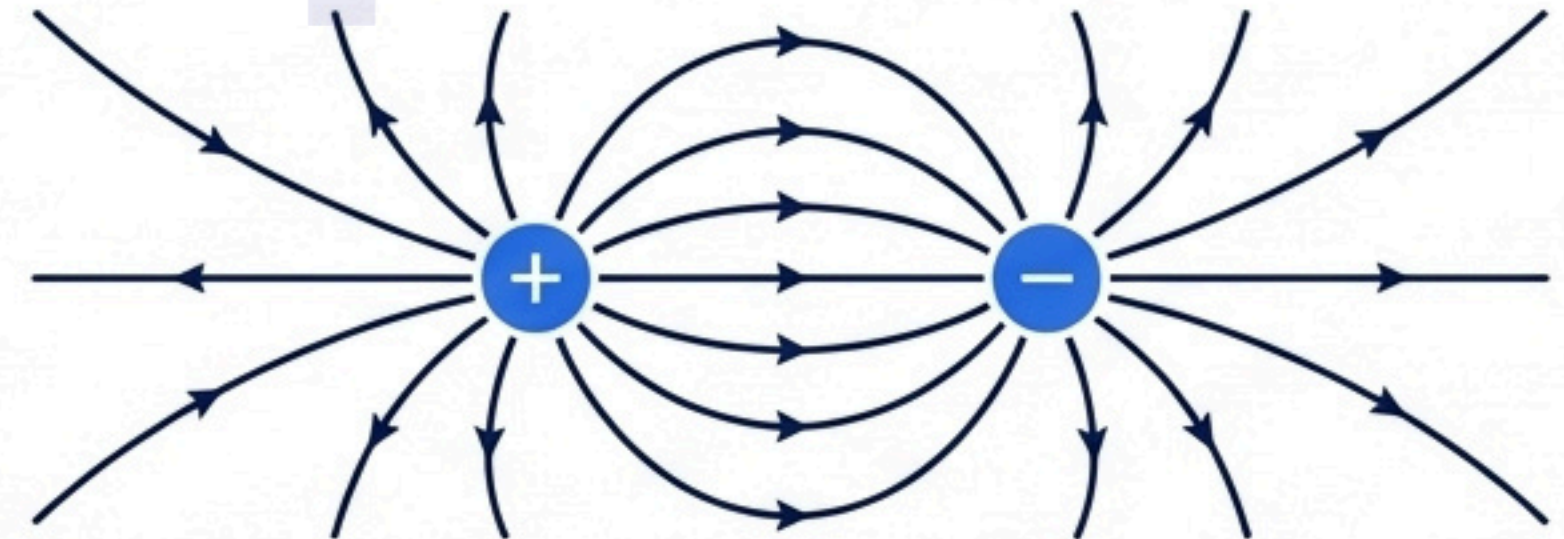
Single Negative ($q < 0$)



Two Like Charges ($+q, +q$)



Electric Dipole ($+q, -q$)



The Four Golden Rules of Field Lines



Origin & Termination

Start at positive charges and end at negative charges. (For a single charge, they start/end at infinity).



Continuous Curves

In a charge-free region, field lines are perfectly continuous without any sudden breaks.



No Intersections

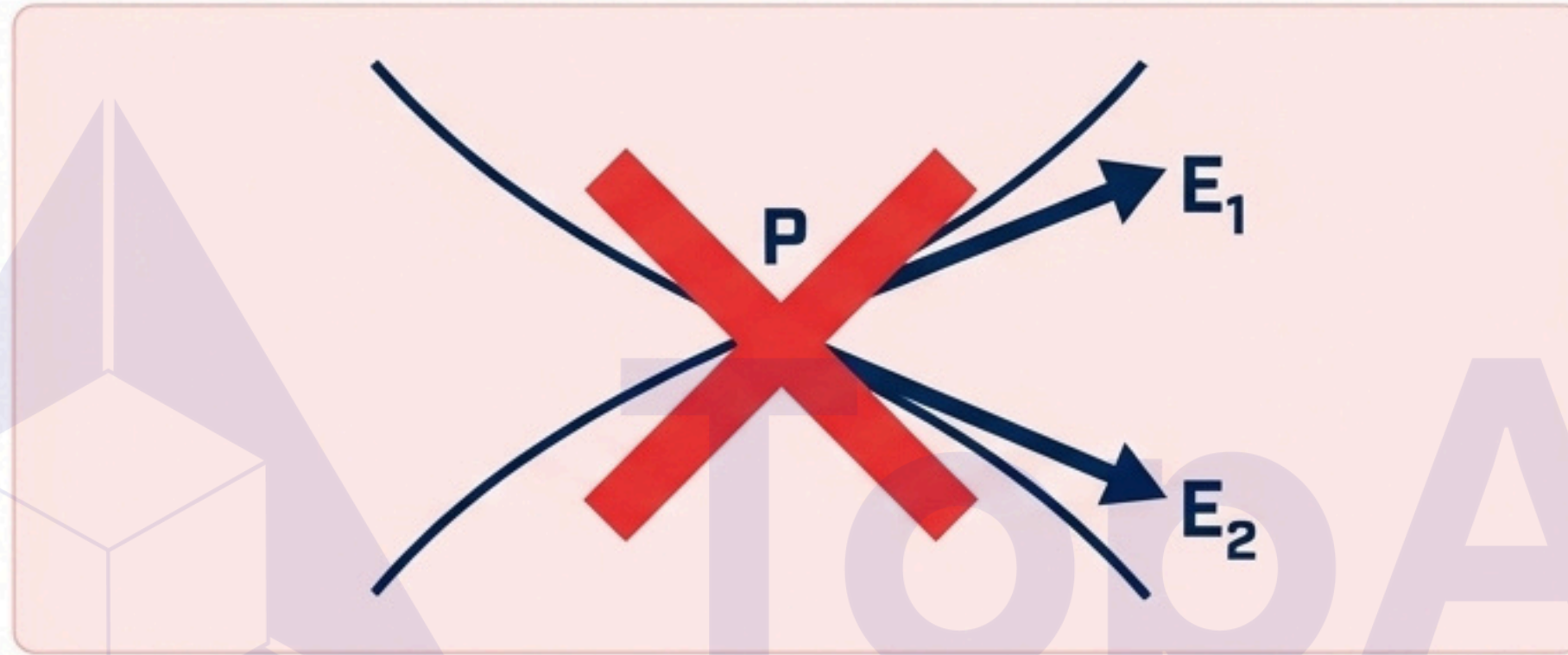
Two field lines can never cross each other under any circumstances.



No Closed Loops

Electrostatic field lines never form closed loops, which reflects the conservative nature of the electric field.

Common Exam Trap: Intersecting Lines

**The Trap:**

Drawing intersecting field lines or assuming multiple field directions at one point.

The Proof:

If two lines crossed, there would be two tangents at the intersection. This means the electric field would have two different directions at a single point—which is physically absurd!

Summary

- ✓ **Tangent** = Exact direction of net field.
- ✓ **Line Density** = Relative strength of field.
- ✓ **Flow** = Positive to Negative.
- ✓ **Rule** = Lines never cross; no closed loops.

Check Your Understanding

If field lines are parallel and equally spaced, what does this tell you about the electric field?

The field is uniform in magnitude and direction.

Why don't electrostatic field lines form closed loops?

Due to the conservative nature of the electric field.

Next Module: 1.9 Electric Flux →



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