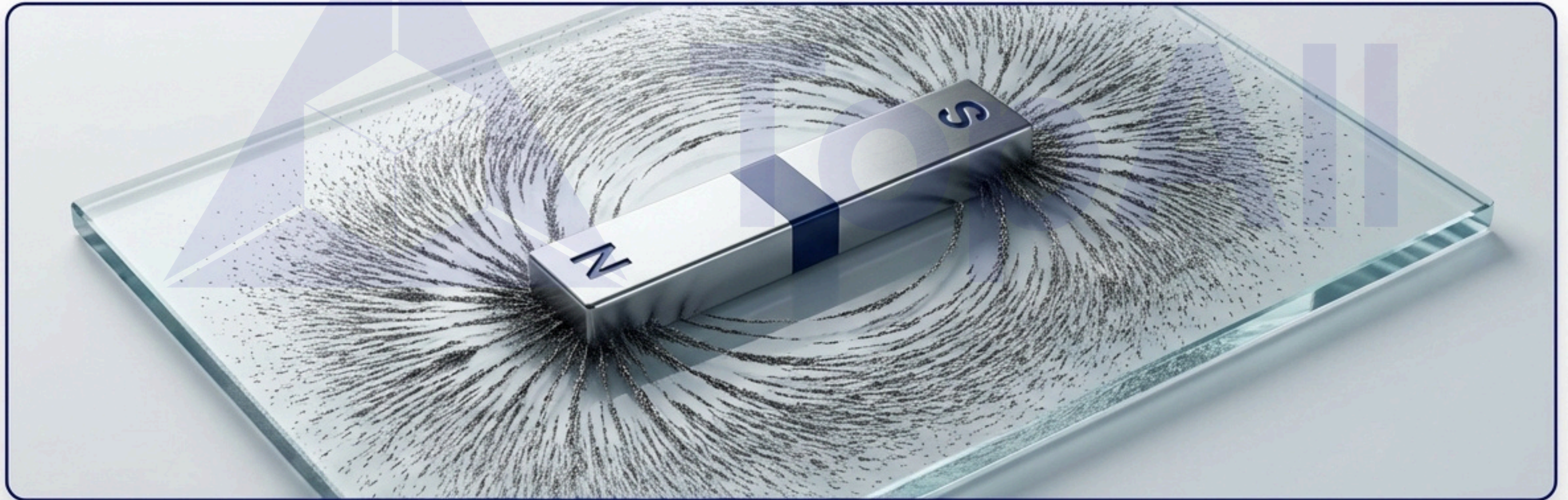


The Bar Magnet

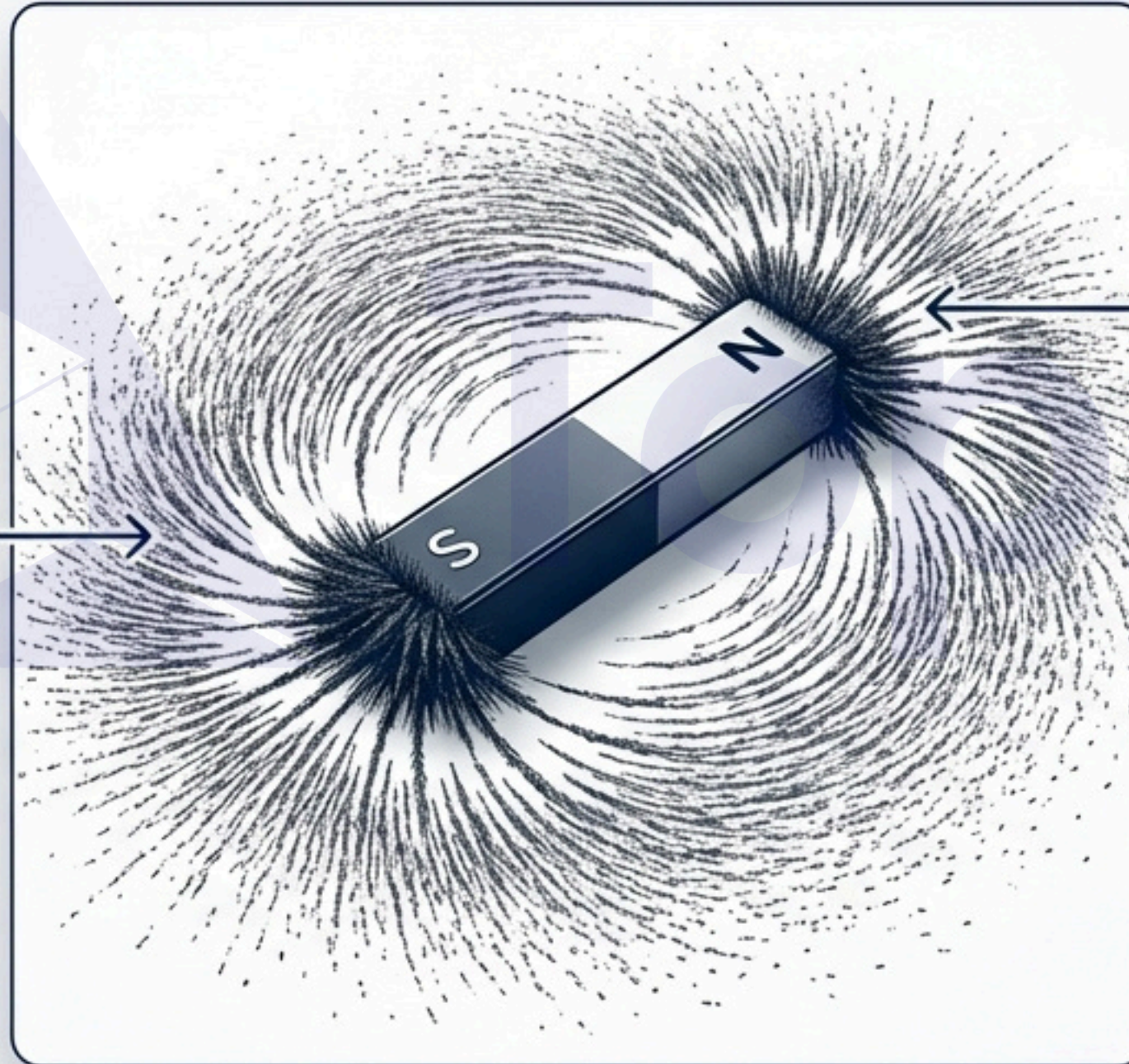
Unveiling the Magnetic Dipole



Visualizing the Invisible Field

The Pattern

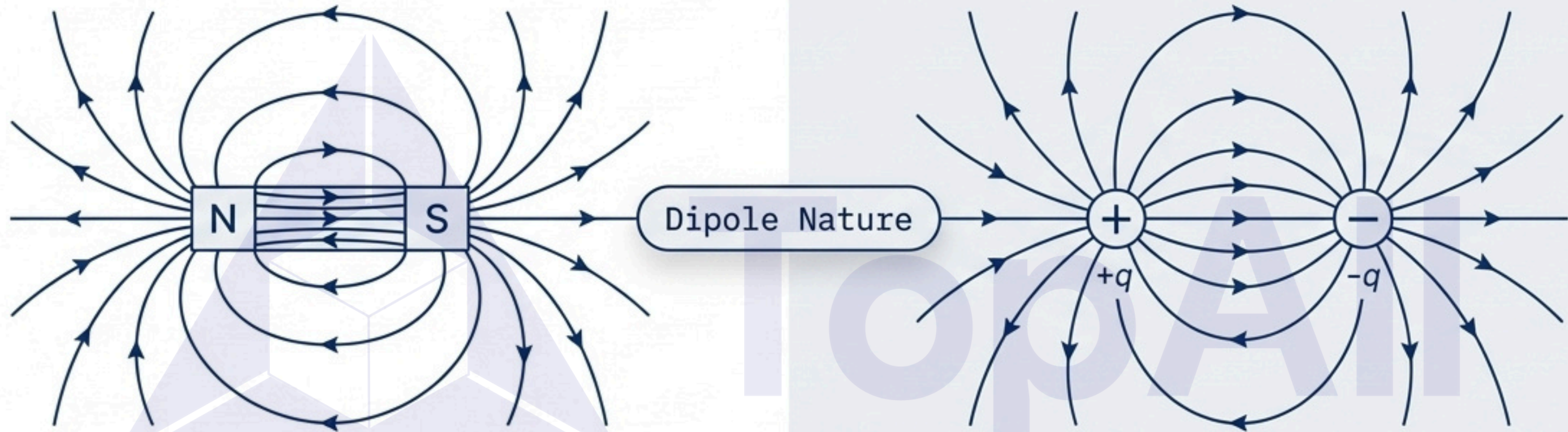
Iron filings sprinkled over a glass covering a bar magnet spontaneously arrange themselves into distinct, continuous curves mapping the field.



Pole Concentration

The filings cluster most densely at the two extreme ends of the magnet. This indicates that the magnetic strength is highly concentrated in these specific regions.

The Magnetic Dipole



Mimicking Charges

The continuous looping pattern of the iron filings perfectly mimics the electric field lines generated by an electric dipole (a pair of equal and opposite charges).

Two Poles

This structural proof suggests the bar magnet inherently possesses two distinct centers of magnetic strength—making it fundamentally a magnetic dipole. (Isolated magnetic monopoles do not exist).



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Key Highlights

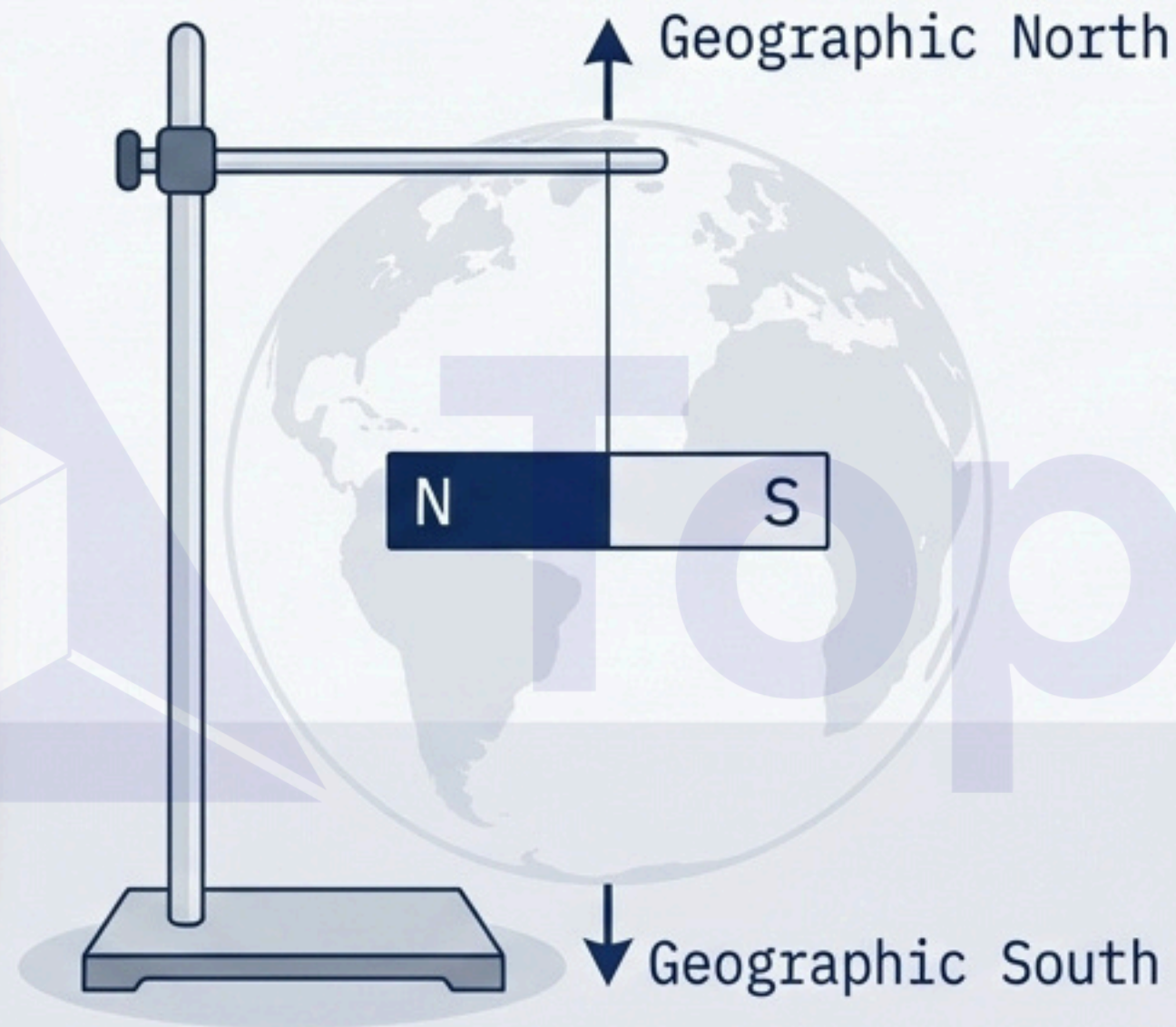
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Finding North and South

Free Suspension

When a bar magnet is suspended freely so it can rotate in a horizontal plane, it inherently aligns itself along the Earth's local North-South axis.

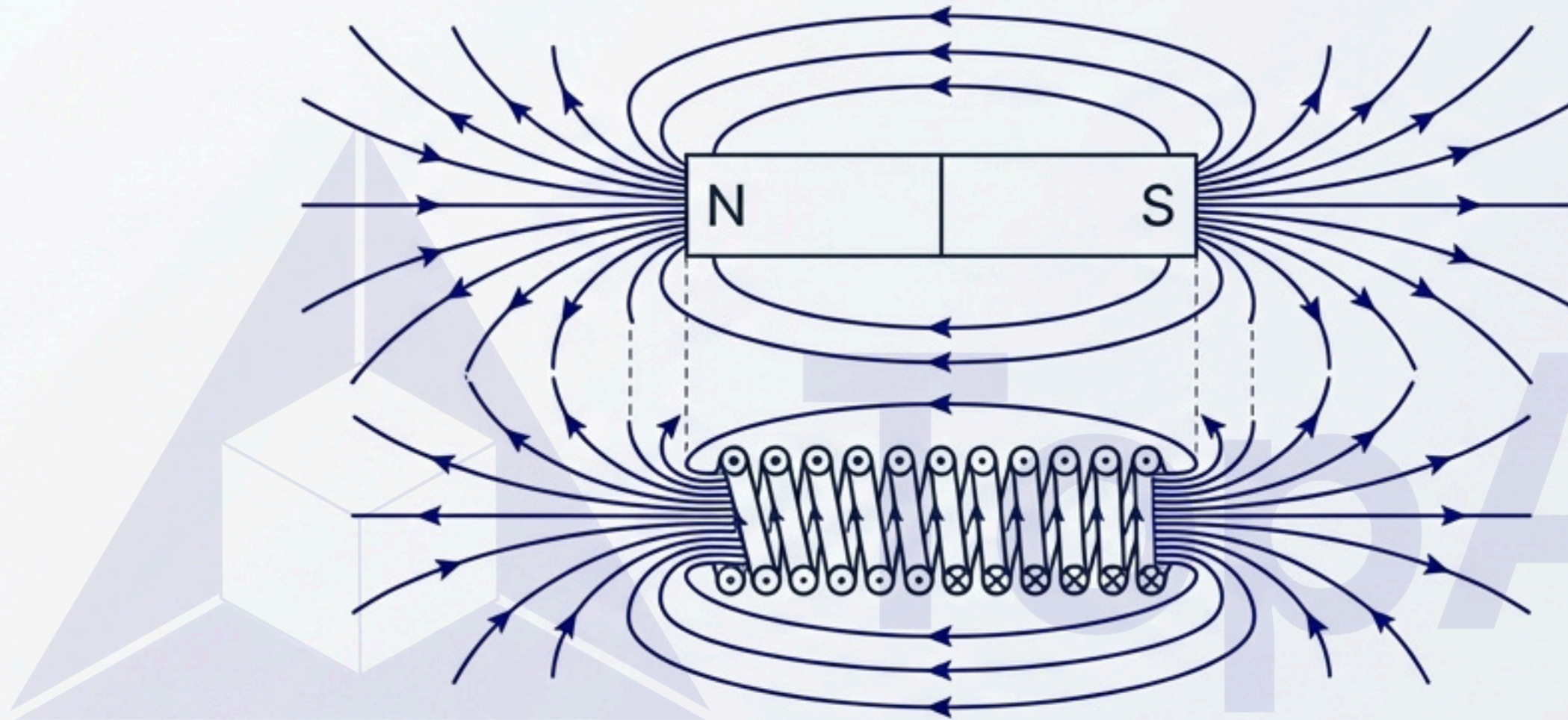


Pole Designation

The tip pointing towards the geographic North is defined as the North Pole, and the tip pointing towards the geographic South is the South Pole.

Key Takeaway: Earth behaves as a magnet itself, providing the external magnetic field that forces this uniform alignment.

The Solenoid Analogy



A Striking Resemblance

A finite solenoid carrying an electric current produces an external magnetic field pattern that is visually and mathematically equivalent to that of a bar magnet.

Ampere's Hint

This hints at Ampere's hypothesis: all magnetic phenomena can ultimately be explained in terms of circulating currents. A bar magnet acts precisely as an equivalent solenoid.

Essential Exam Takeaways

Filings Pattern Meaning

Reveals continuous magnetic field lines. Tangents to these lines indicate field direction; density indicates field strength.

Two Poles

Magnetic strength is exclusively concentrated at the ends of the magnet, termed the North and South poles.

Dipole Nature

The field geometry mimics an electric dipole. A magnet fundamentally exists as a **dipole**; breaking it simply creates two smaller dipoles.

Alignment Behavior

A freely suspended bar magnet always rests in the geographic North-South direction due to interaction with Earth's magnetic field.



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