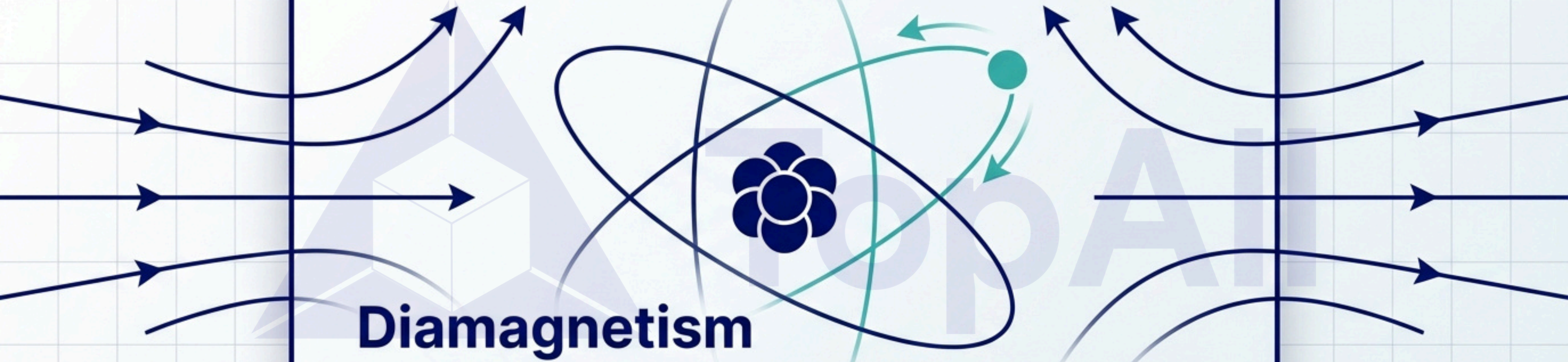


NEET Concept Deck — Section 5.5.1



Diamagnetism

The Magnetic Shield: Macroscopic Behavior to Quantum Origins

Seeking the Weaker Field

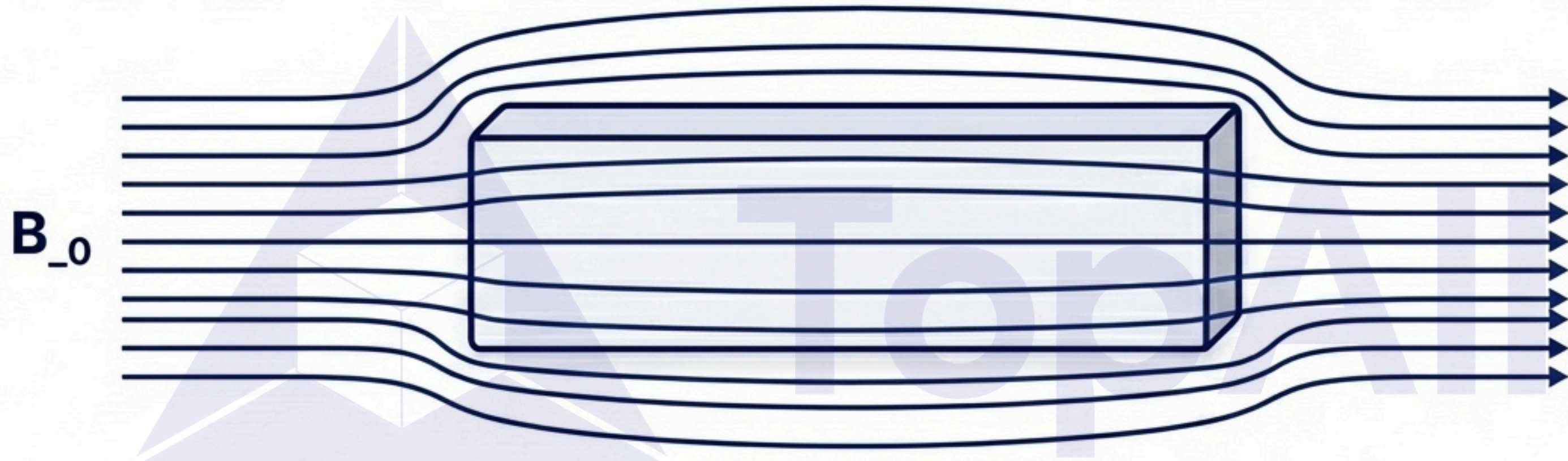


The Core Rule

Unlike everyday magnets that attract metals, diamagnetic substances are weakly repelled by magnets.

Moves from Stronger → Weaker Field

Expelling the Magnetic Field



$$[B_{\text{inside}} < B_{\text{outside}}]$$

Field Expulsion

The material repels or expels external magnetic field lines.

Internal Reduction

The field inside the material is reduced (typically by a slight margin, roughly 1 part in 10^5).



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$$E=mc^2$$



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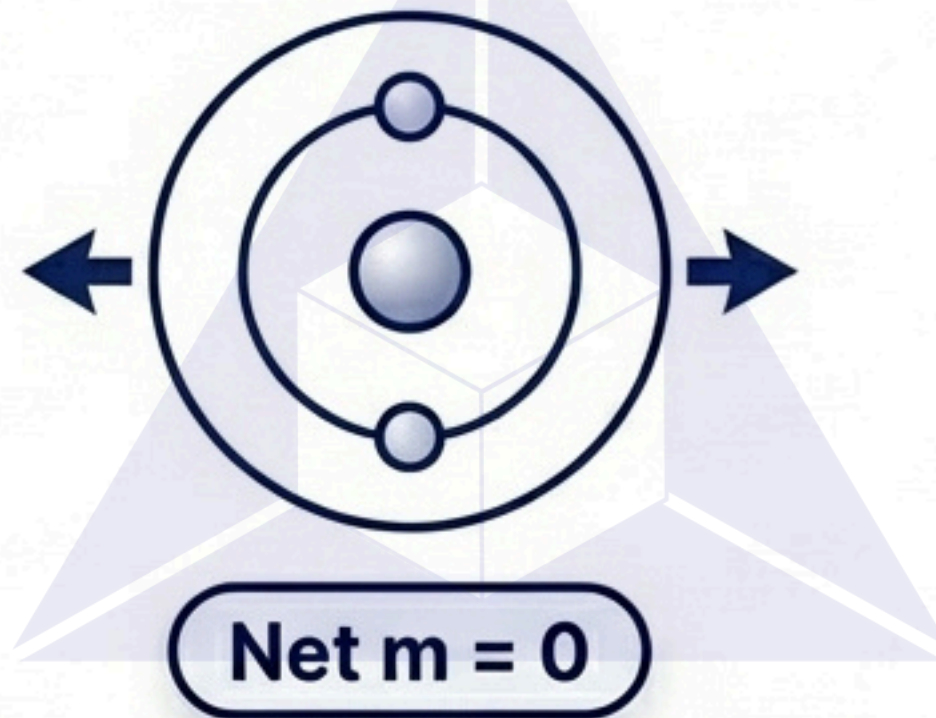
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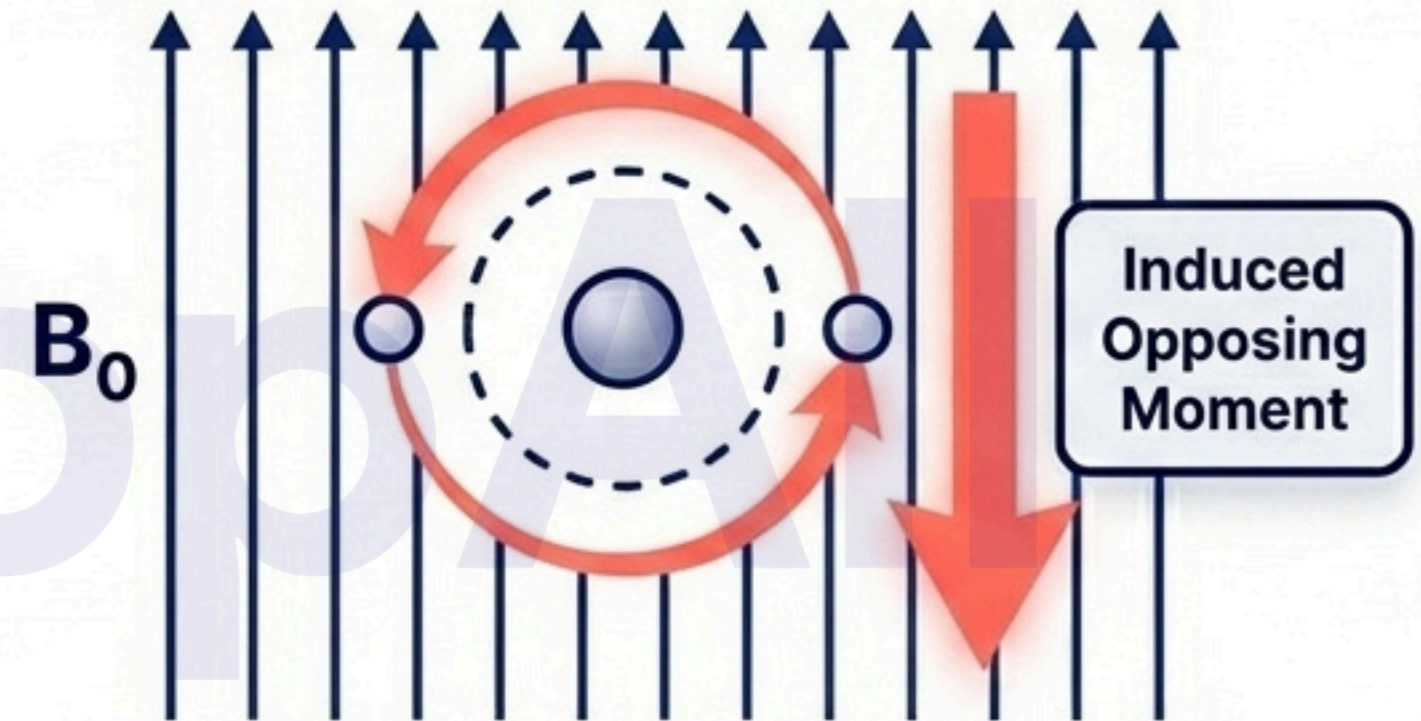


The Quantum Mechanism

Before External Field



External Field B_0 Applied



According to Lenz's Law, the applied field induces currents (altering electron speeds) that create a net magnetic moment opposite to the applied field.

Result: Induced magnetic moment perfectly opposes the external field, causing repulsion.

Defining Diamagnetic Materials

Formula Zone

Susceptibility (χ) — Small and negative.

$$[-1 \leq \chi < 0]$$

Relative Permeability (μ_r) — Less than 1.

$$[0 \leq \mu_r < 1]$$

Permeability (μ). $[\mu < \mu_0]$

Materials Roster

[Bismuth]

[Copper]

[Lead]

[Silicon]

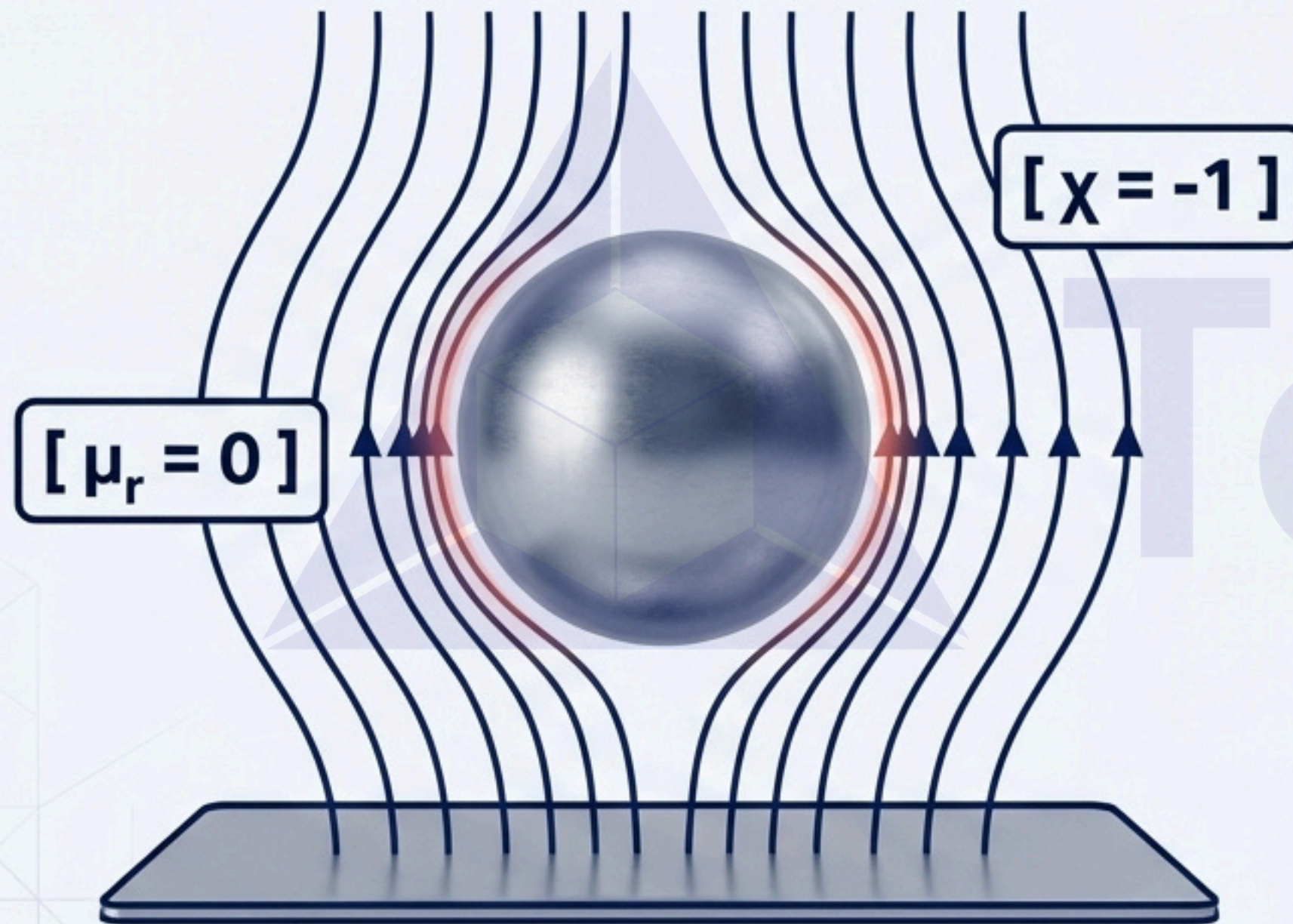
[Nitrogen (STP)]

[Water]

[NaCl]

Universal but Hidden — Diamagnetism is present in all substances, but the effect is so weak it is usually masked by paramagnetism or ferromagnetism.

Superconductors & Perfect Diamagnetism



Perfect Expulsion

Metals cooled to very low temperatures exhibit **perfect conductivity** and **perfect diamagnetism**. The magnetic field is completely expelled.

Meissner Effect

The phenomenon where a superconductor **perfectly repels** a magnet (and is repelled by it, via Newton's Third Law).

[Real-world: Maglev Superfast Trains]

Key Takeaways

- 1 Behavior:** Moves from stronger to weaker fields; weakly repels magnets.
- 2 Mechanism:** Induced orbital magnetic moments oppose the external field (Lenz's Law).
- 3 Limits:** Susceptibility $[\chi]$ is always negative.

Do Not Confuse

Diamagnetism	Paramagnetism
Repelled by magnets	Attracted to magnets
Moves Strong $\rightarrow$ Weak	Moves Weak $\rightarrow$ Strong
Field lines expelled	Field lines concentrated
$[\chi]$ is Negative	$[\chi]$ is Positive (and small)



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