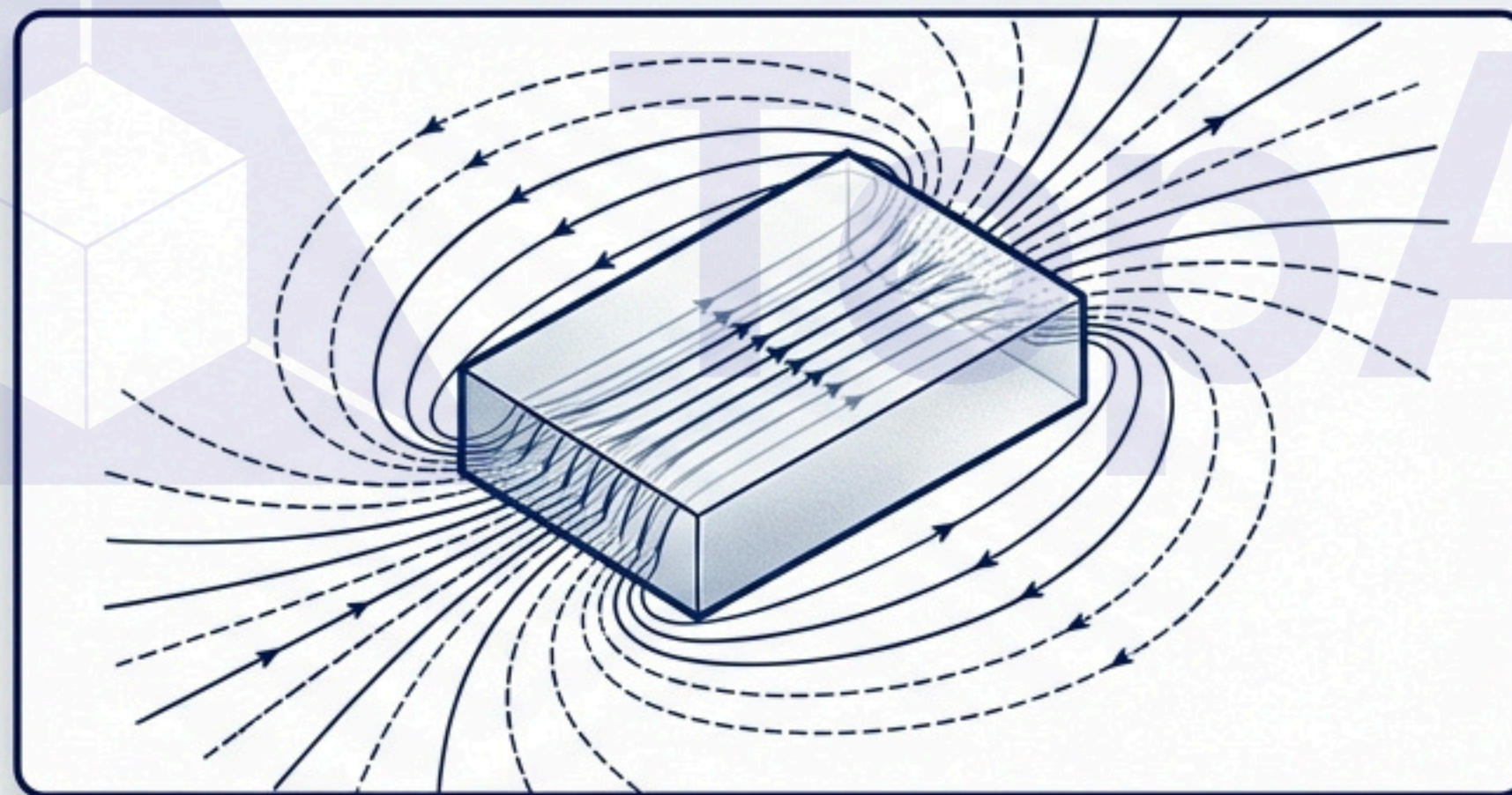


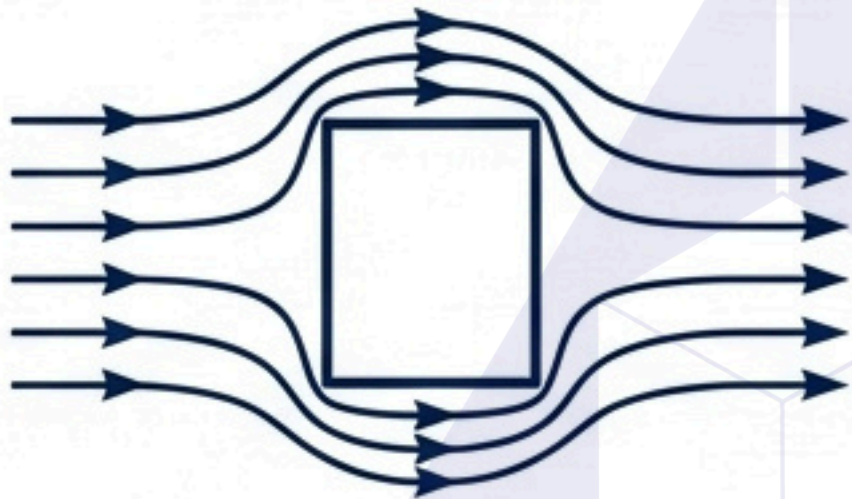
Magnetic Properties of Materials

5.5 Concept Overview: Diamagnetic, Paramagnetic, and Ferromagnetic Classifications



The Big Classification

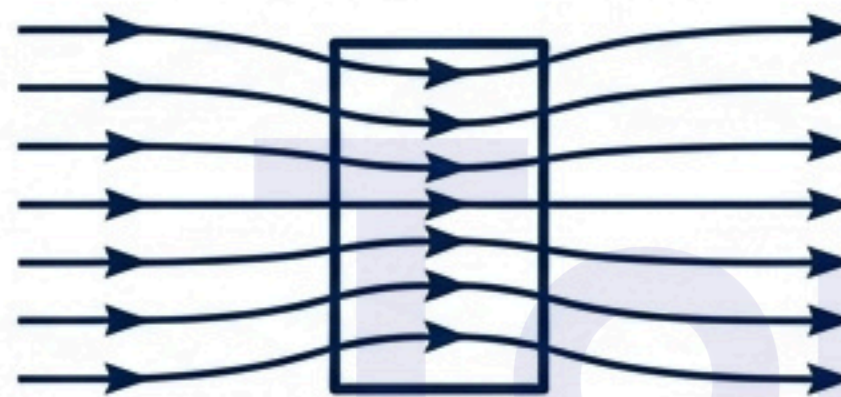
Diamagnetic



Weakly Repelled

Tends to move from stronger to weaker parts of the magnetic field.

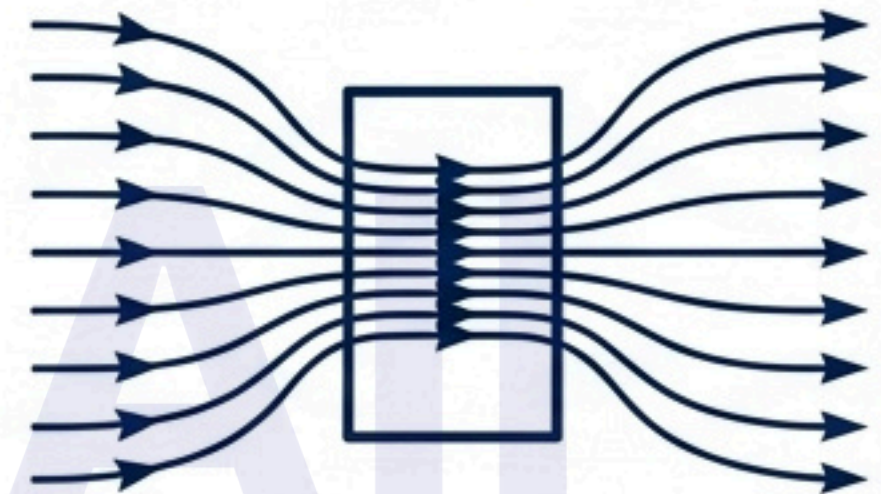
Paramagnetic



Weakly Attracted

Tends to move from weak to strong magnetic field regions.

Ferromagnetic



Strongly Attracted

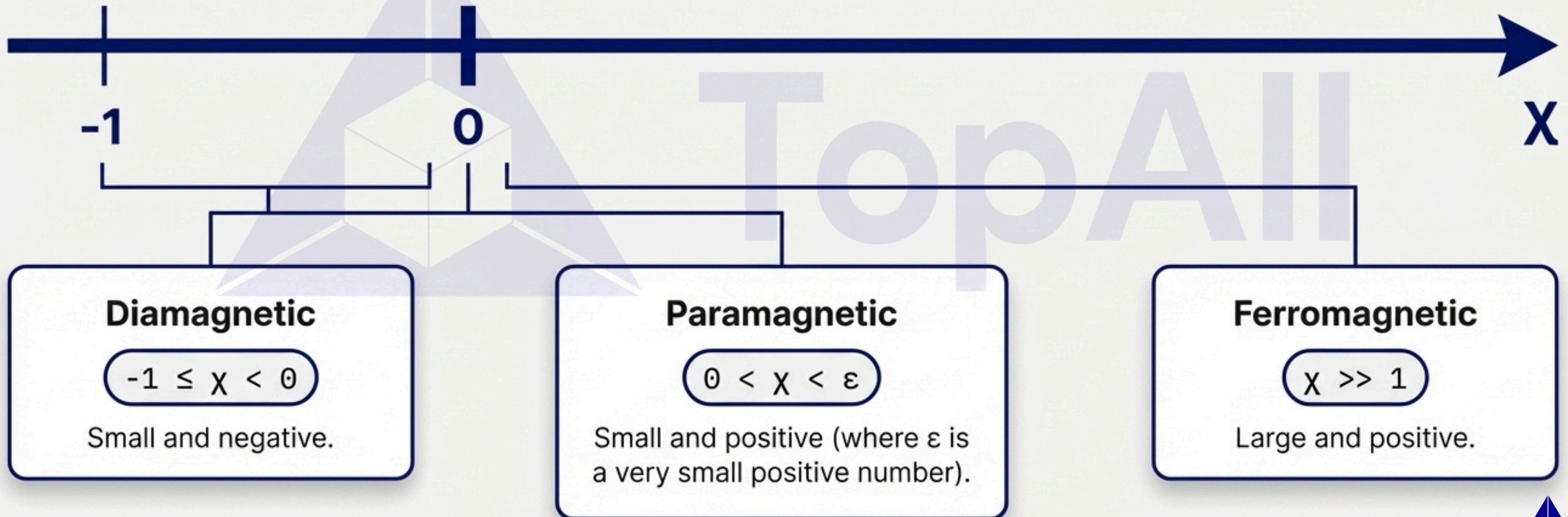
Extremely strong tendency to move into regions of high magnetic field.

All materials fall into one of these three categories based on how they respond to an external magnetic field.

Magnetic Susceptibility

Classification by χ Ranges

Susceptibility (χ) measures how a material responds to an external field.





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Key Highlights

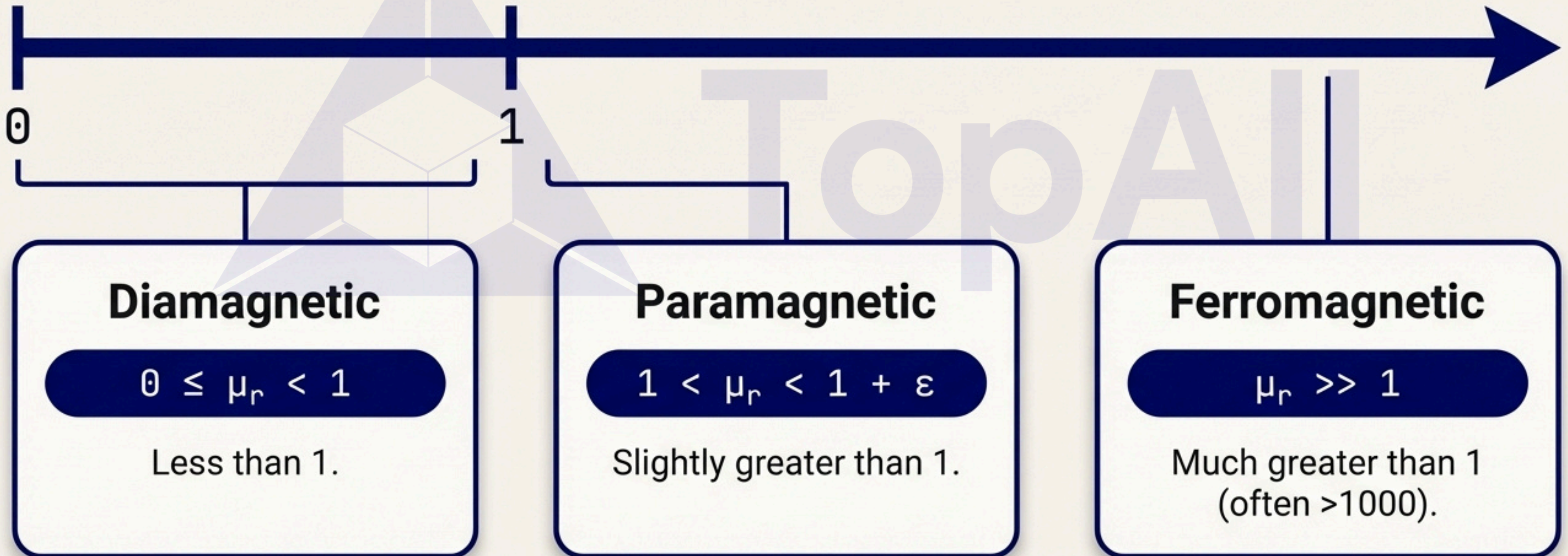
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Relative Permeability

Classification by μ_r Ranges

Permeability ($\mu_r = 1 + \chi$) indicates the degree of magnetization a material obtains in response to an applied magnetic field.



Master Diagnostic Matrix

	Diamagnetic	Paramagnetic	Ferromagnetic
Susceptibility (χ)	$-1 \leq \chi < 0$	$0 < \chi < \varepsilon$	$\chi \gg 1$
Relative Permeability (μ_r)	$0 \leq \mu_r < 1$	$1 < \mu_r < 1 + \varepsilon$	$\mu_r \gg 1$
Permeability (μ)	$\mu < \mu_0$	$\mu > \mu_0$	$\mu \gg \mu_0$

Key Takeaway: Diamagnetism is universal but weak; Ferromagnetism is rare but dominant.

Up Next

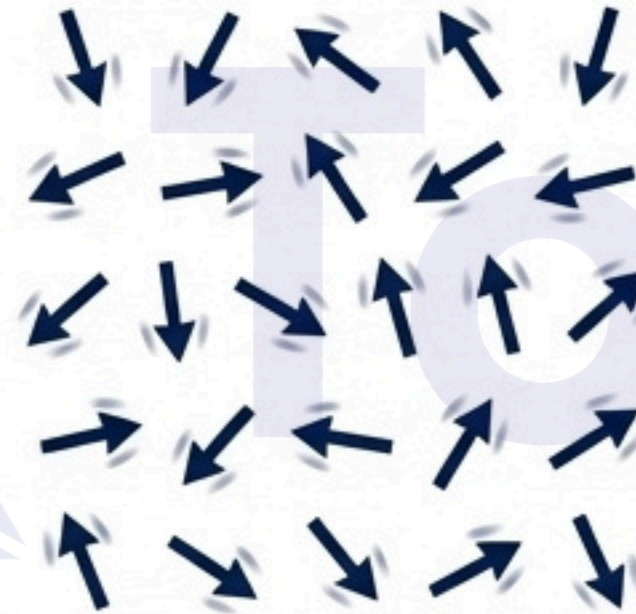
Deep Dive: The Microscopic Origins

5.5.1 Diamagnetism



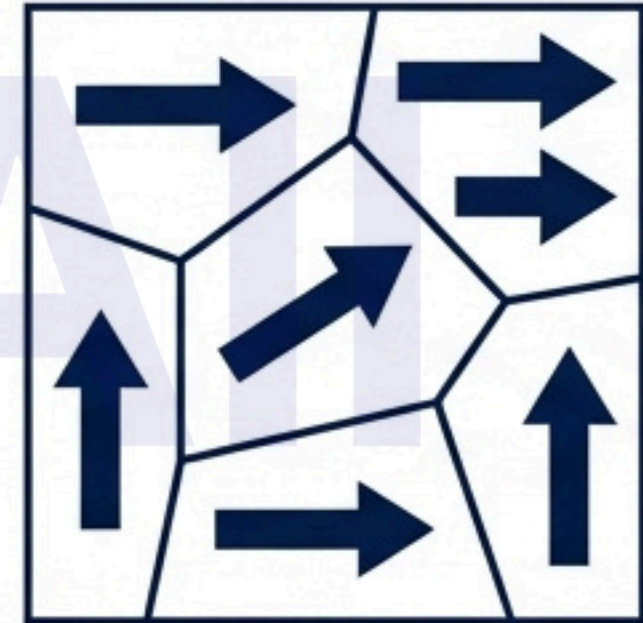
Orbital magnetic moments
& Lenz's Law

5.5.2 Paramagnetism



Permanent atomic dipoles
& thermal randomness

5.5.3 Ferromagnetism



Macroscopic domains &
spontaneous alignment

Swipe to explore section 5.5.1



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