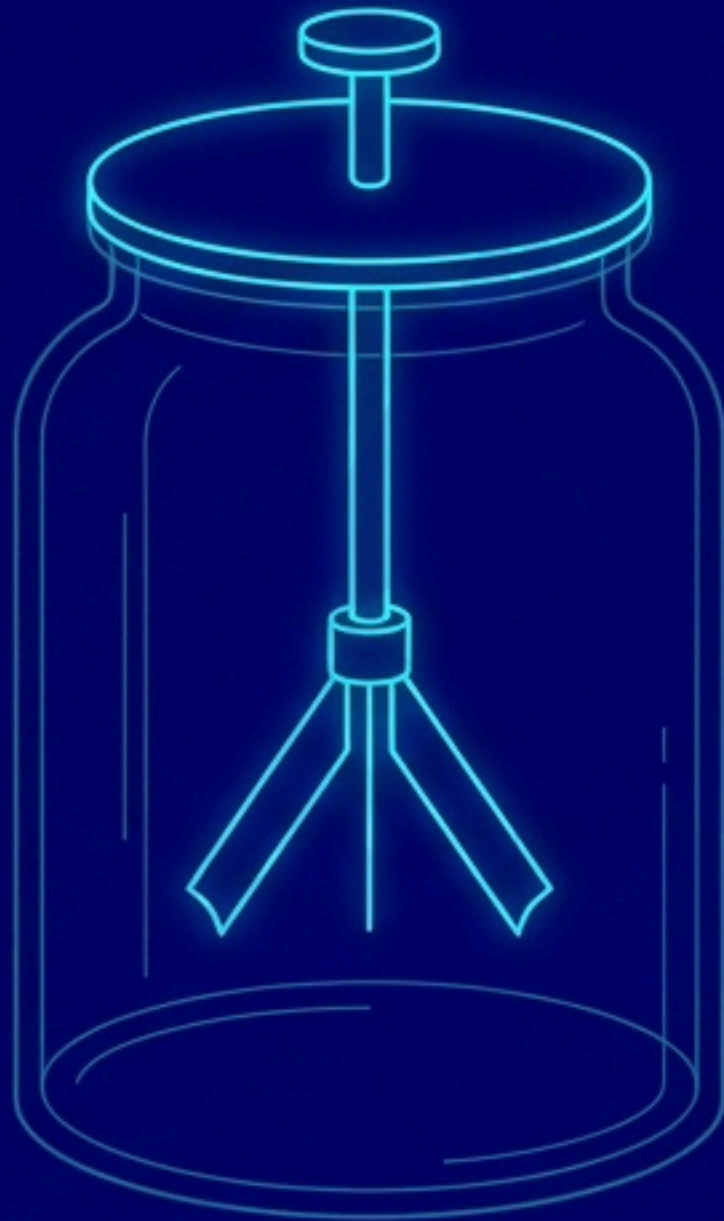
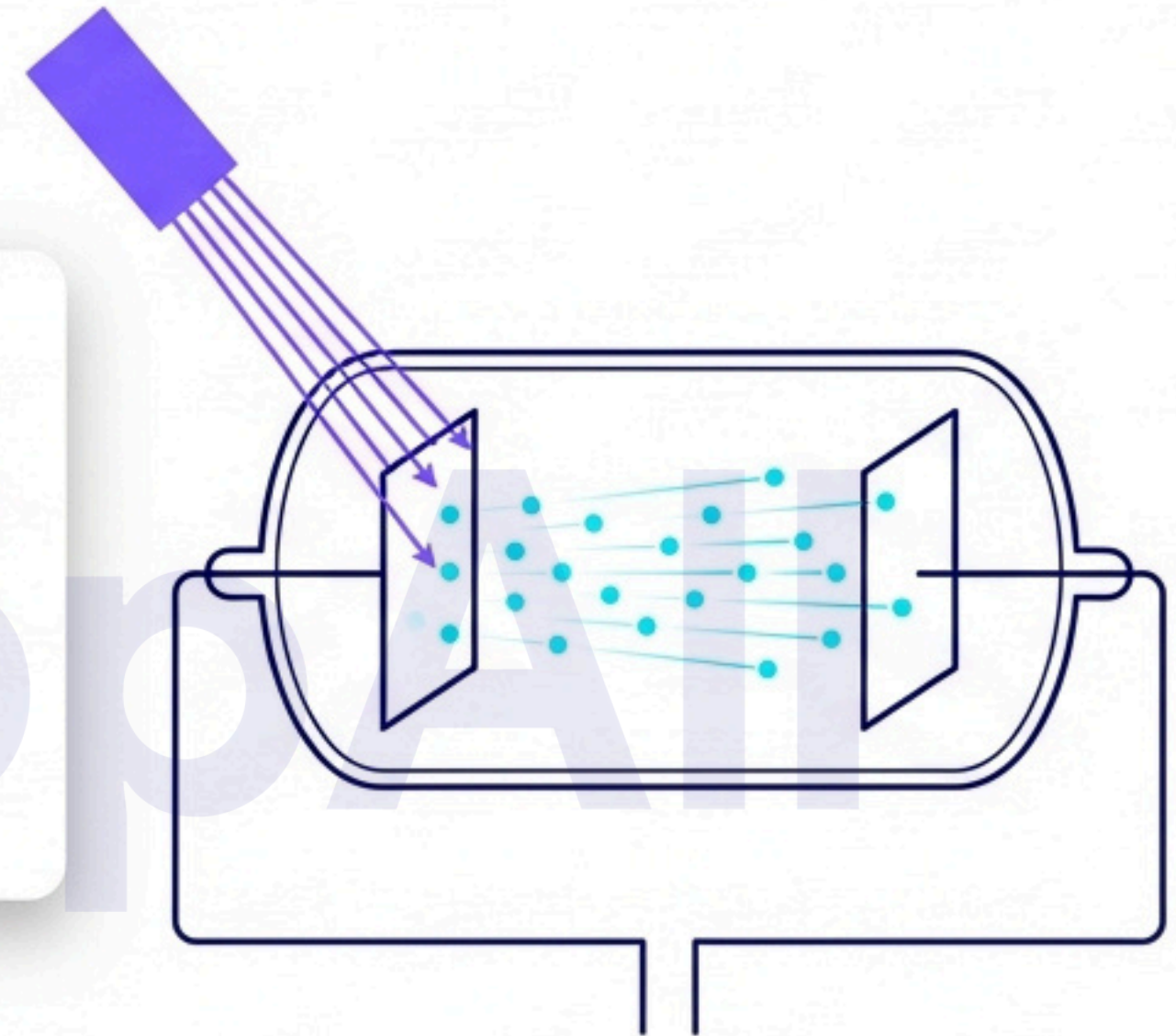
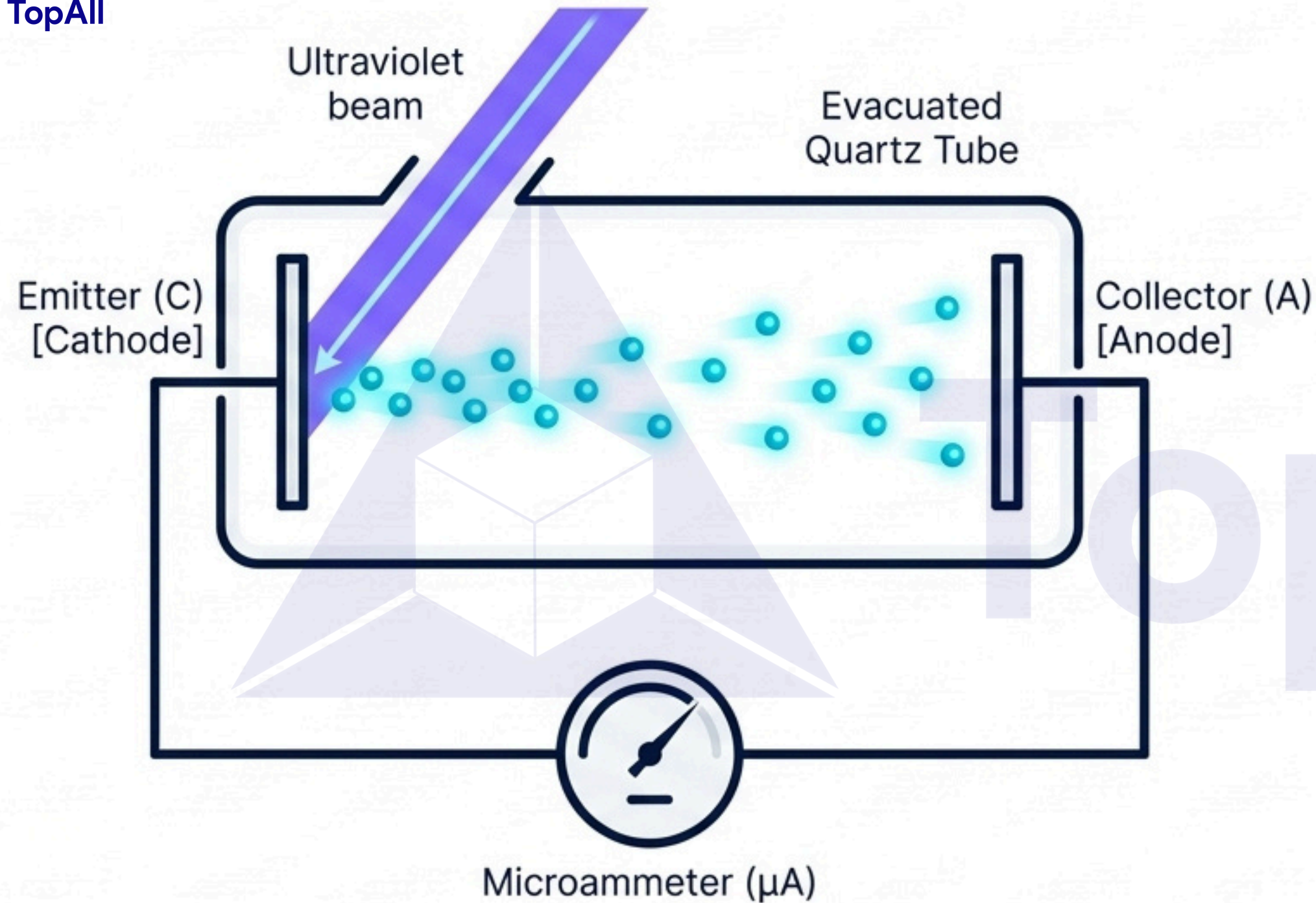




Hallwachs and Lenard

The experiments that confirmed electron emission by light

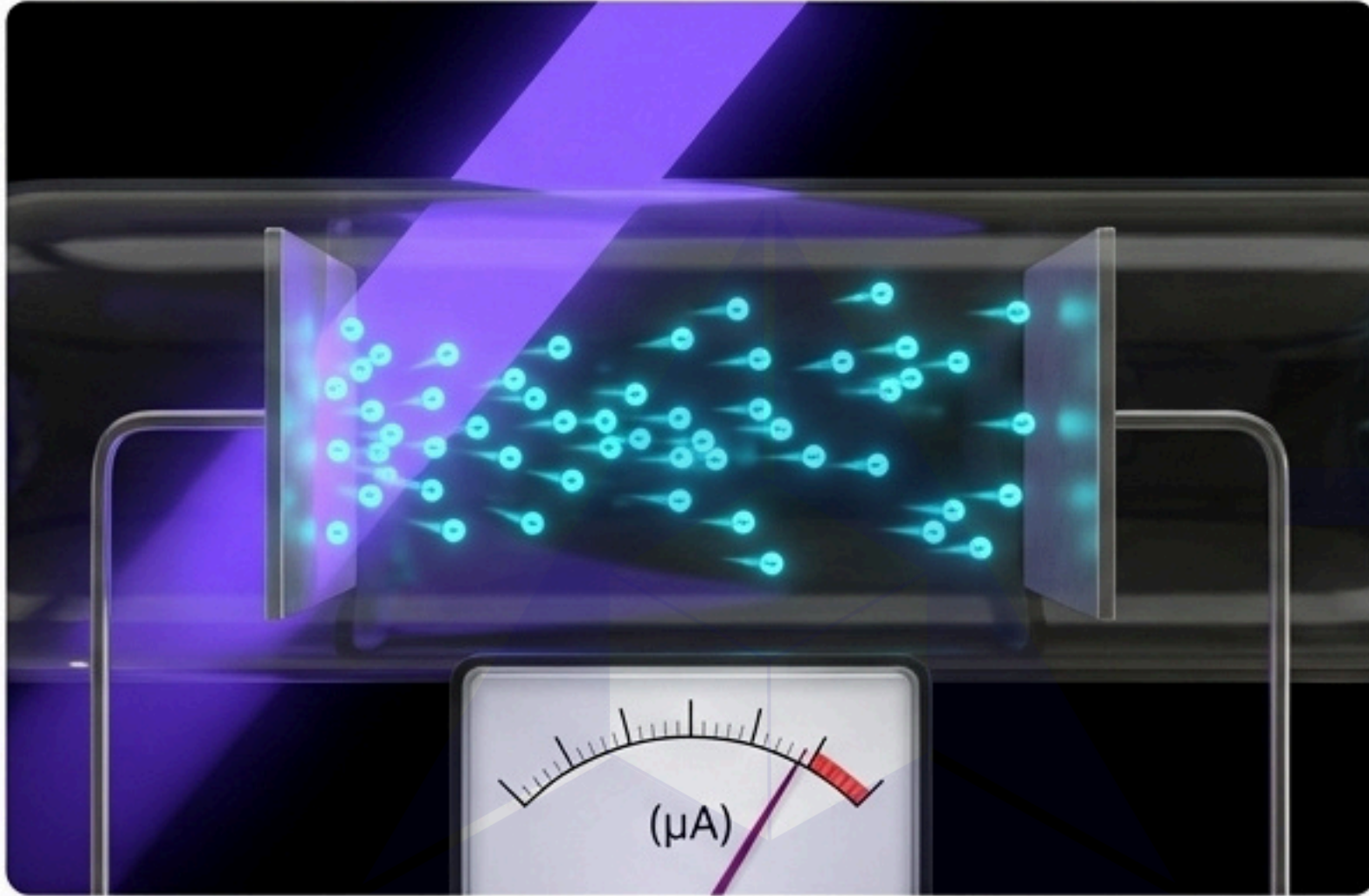




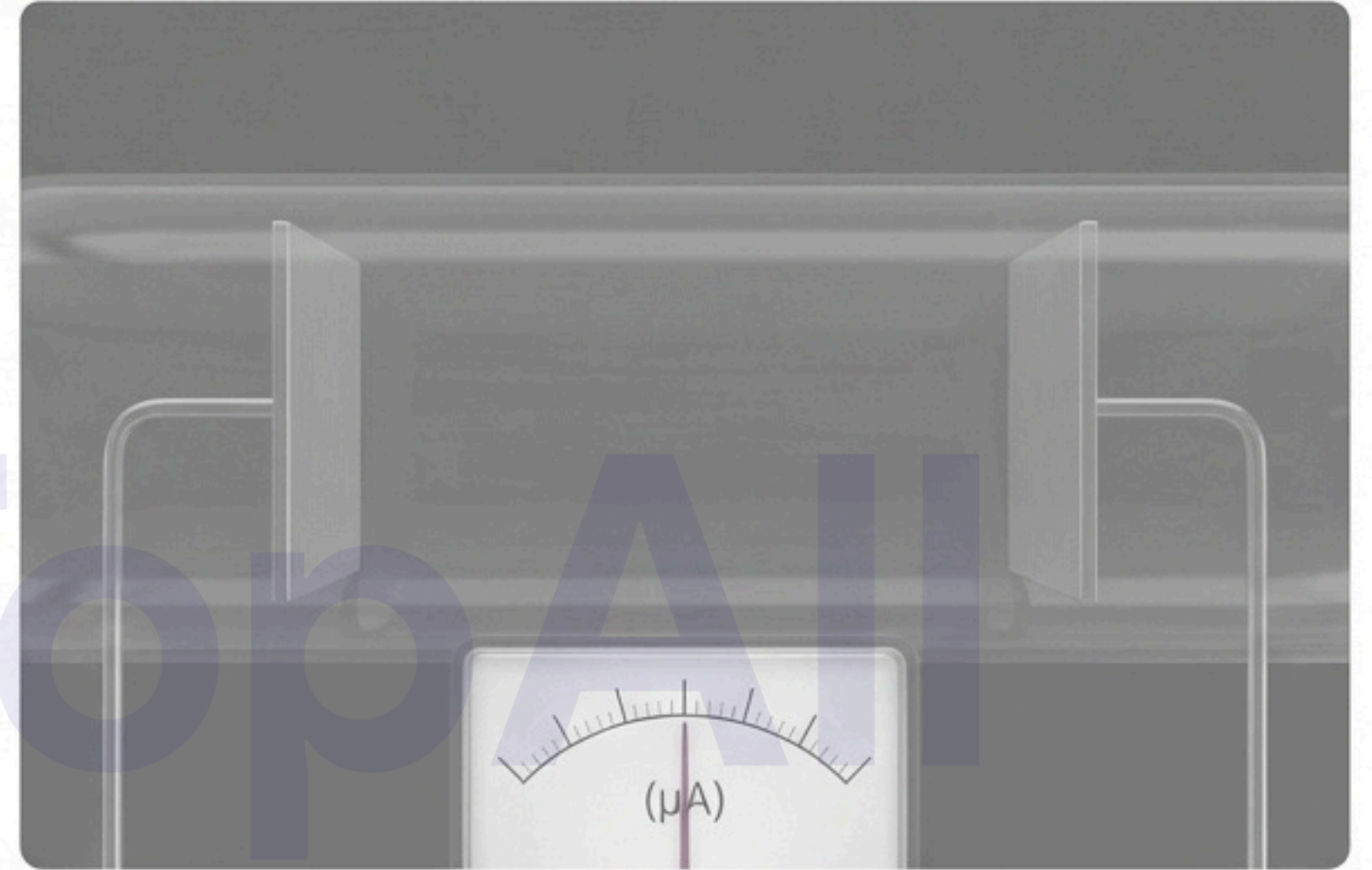
Lenard's Tube Experiment (1886–1902)

When UV radiation strikes the emitter plate, negatively charged particles are ejected. They are pulled toward the positive collector plate, completing the circuit.

Current Stops When Light Stops



Light ON $\rightarrow$ Current Flows



Light OFF $\rightarrow$ No Current

The Boolean Proof: This instantaneous binary behavior proved definitively that the incident light itself was the sole cause of electron emission and the resulting current in the external circuit.



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$$E=mc^2$$



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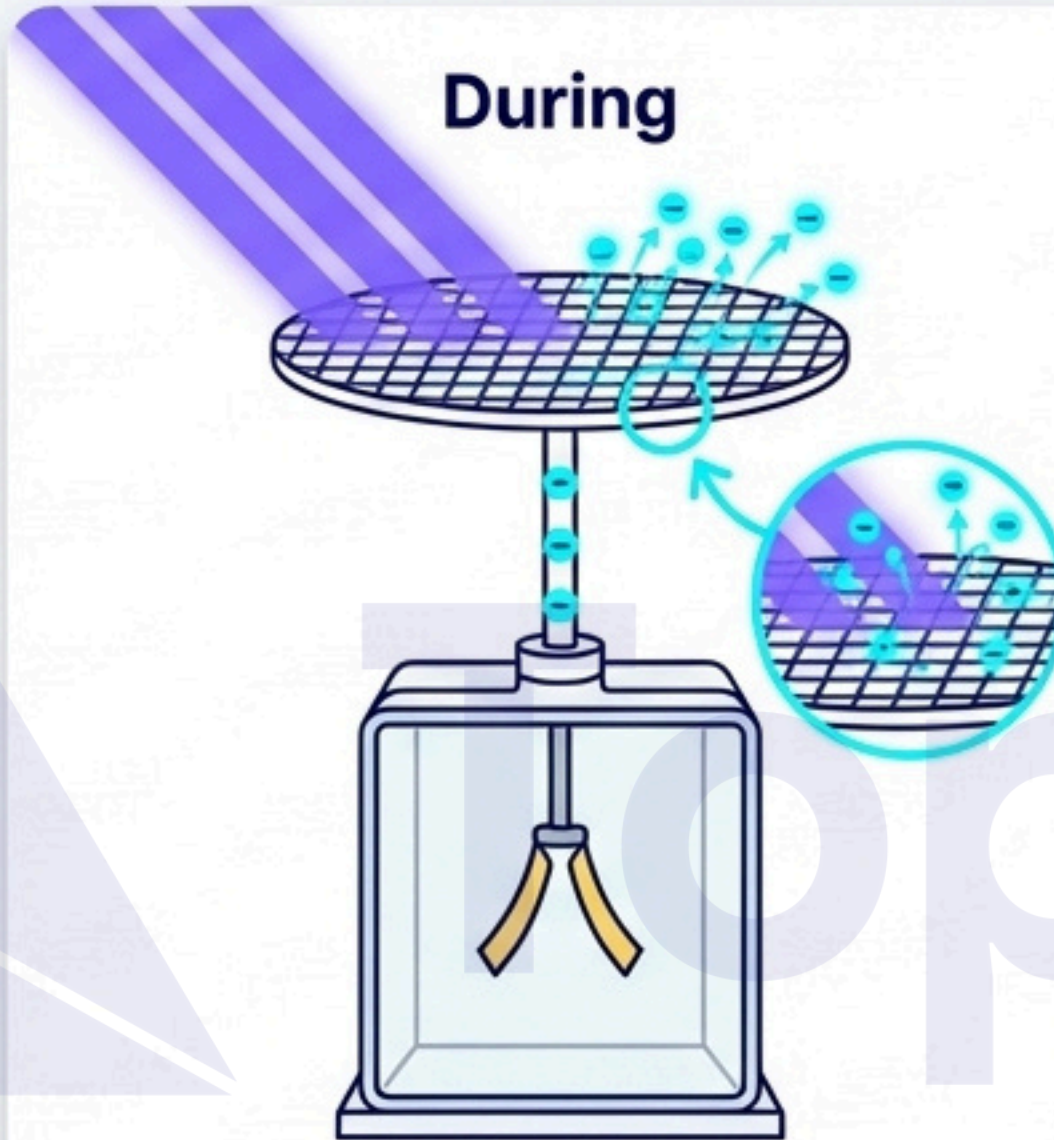
Hallwachs' Zinc Plate Experiment (1888)

Before



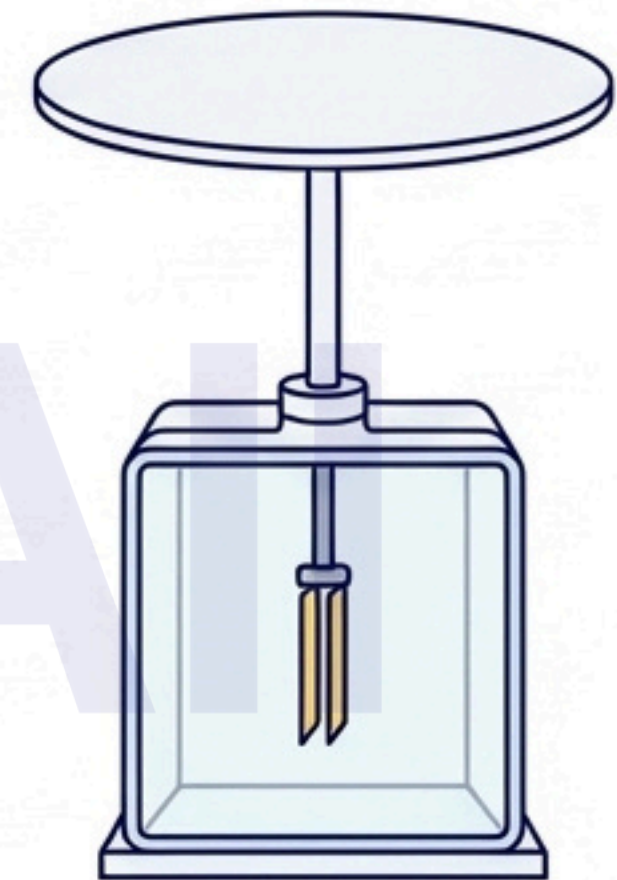
1. Negatively Charged Plate

During



2. UV Light Applied

After



3. Plate Loses Charge

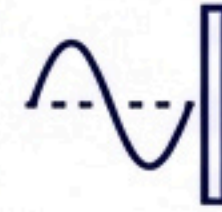
Conclusion: The sudden collapse of the electroscope leaves proved that the particles being expelled from the metal by the UV light carried a strict negative charge.

Important Conclusions



Electron Emission:

Negatively charged particles (later termed photoelectrons) leave the metal surface under the action of light.



Minimum Energy:

Emission does not occur if the incident light frequency is below a certain minimum value (Threshold Frequency), regardless of intensity.



Material Dependence:

The required threshold frequency depends entirely on the specific nature of the emitter material.



UV vs. Visible:

Zinc and Cadmium require high-frequency UV light, while alkali metals (Sodium, Potassium) emit electrons even under visible light.

Key Takeaways: The Photoelectric Effect



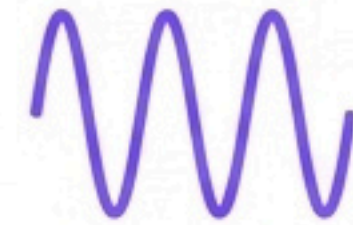
Light Causes Emission

Both evacuated tube and electroscope experiments independently confirmed that incident light forces the ejection of charged particles from metal surfaces.



Material Dependence

Different metals respond differently. Emitters like Caesium react to visible light, whereas metals like Zinc strictly require higher-energy UV radiation.



The Role of UV

Ultraviolet light played the crucial historical role. Its high frequency provided the necessary energy to bridge the work function gap in these early experimental setups.



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