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Welcome!

Physics 194 - Lecture 10

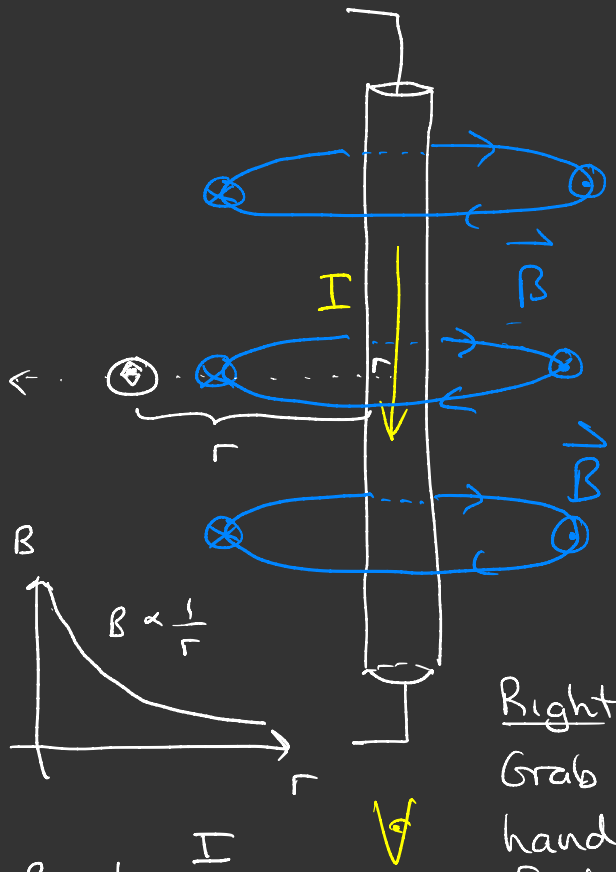
Have a question during class? Please ask it right away, even if it means interrupting in the middle of a thought. I want you to!

Agenda

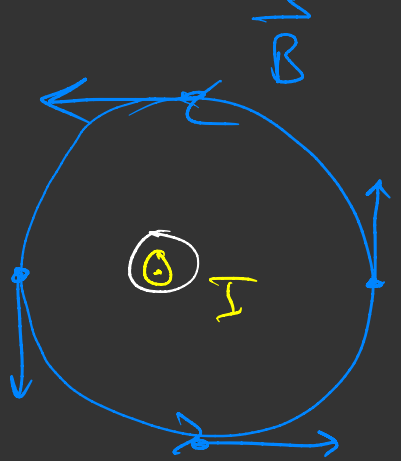
- The magnetic field produced by currents, quantitatively.
- Electromagnetic induction
- The mass spectrometer and the magnetic force exerted on individual particles

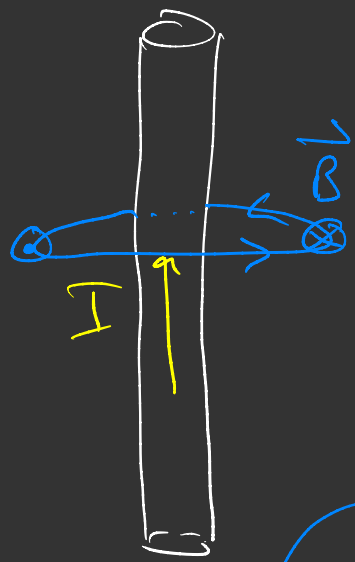
Class starts @2:15 pm

Magnetic field produced by a current



$$B = k_m \frac{I}{r}$$





Right hand rule for the $\vec{B}$-field:

Grab the current with your right hand with your thumb in the direction of the current. Your fingers are wrapping around the current in the way the $\vec{B}$-field does.

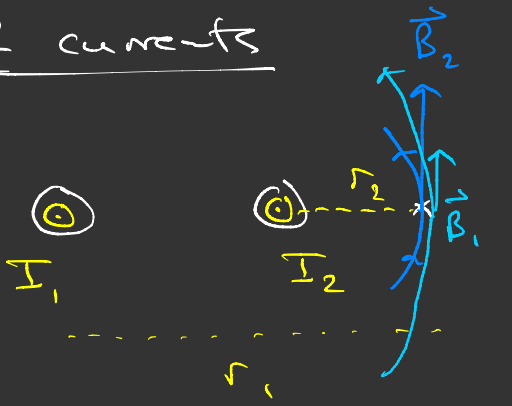
$B = \frac{\mu_0}{2\pi}\frac{I}{r} = k_m \frac{I}{r}$

μ_0 : vacuum permeability

$= 4\pi \times 10^{-7}\ T \cdot m/A$

The magnitude of the B-field produced by a straight current.

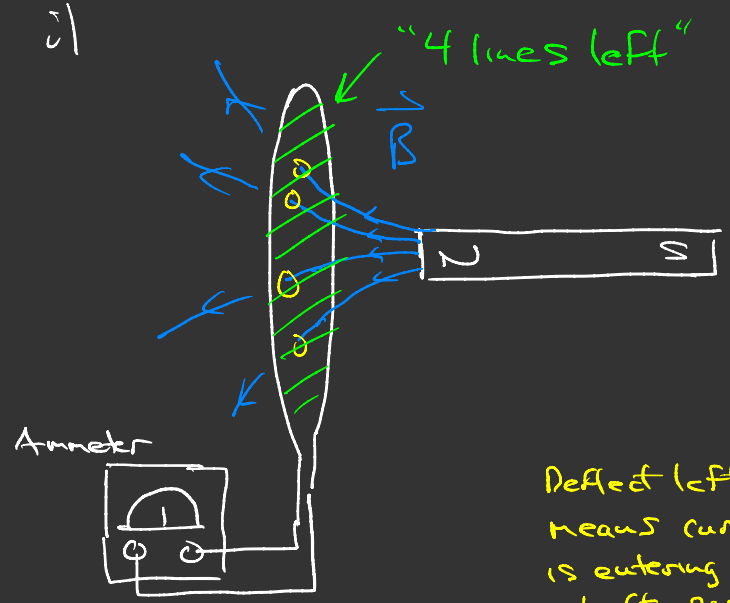
2 currents



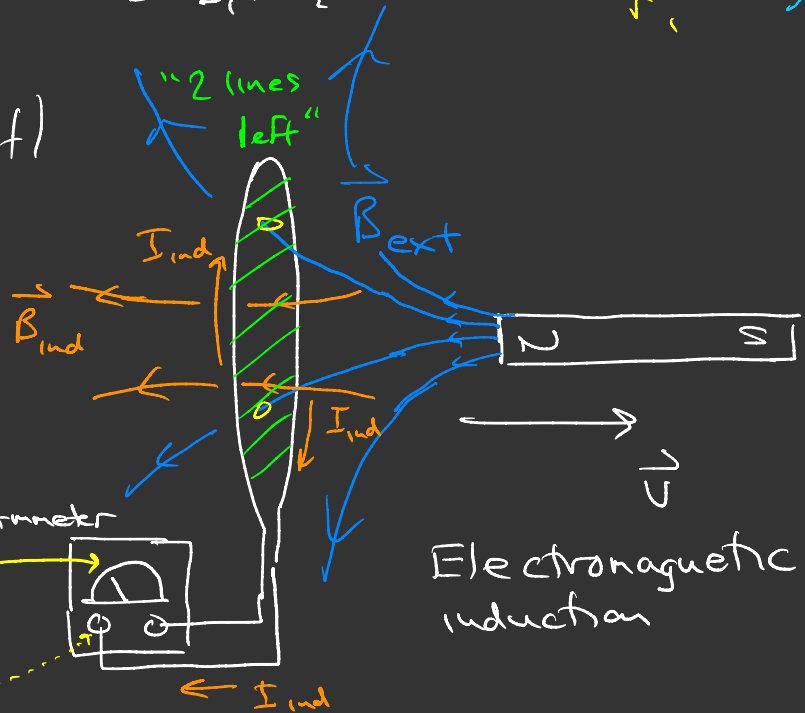
$\vec{B} = \vec{B}_1 + \vec{B}_2$

Lab last week!

a)



f)

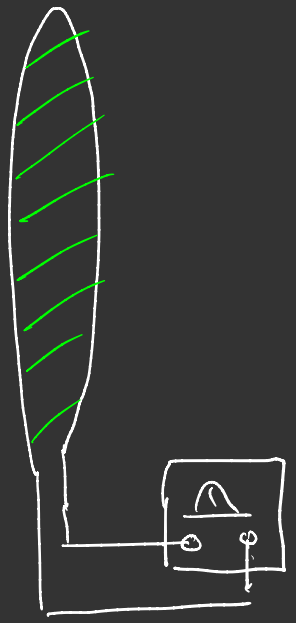


Deflect left means current is entering the left port

Electromagnetic induction

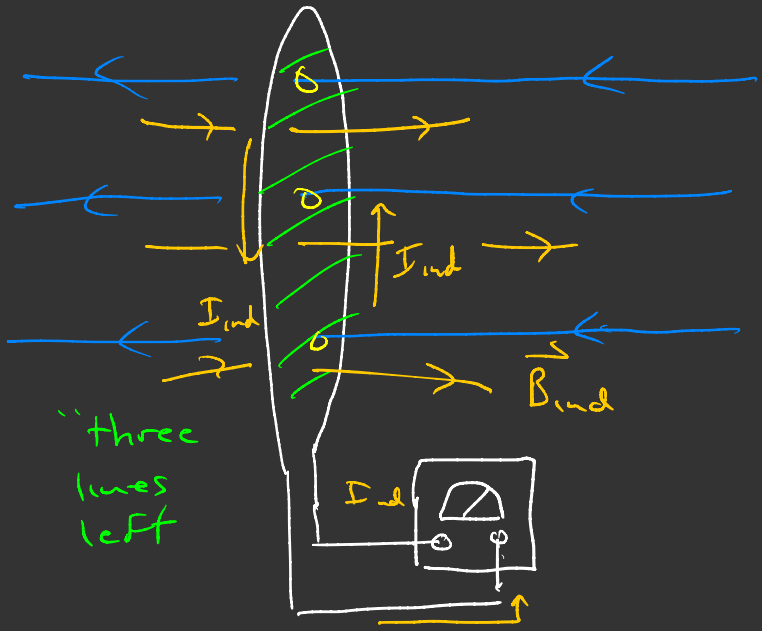
Initial : No $\vec{B}$-field Final

$\vec{B}_{ext} = 0$



"zero lines"

$\vec{B}_{ext}$



"three lines left"

Lenz's law: The induced current I_{ind} will produce an induced $\vec{B}$-field B_{ind} that attempts to restore the external $\vec{B}$-field B_{ext} to what it was a moment before.