Exploring Electromagnetism through Eddy Current Braking

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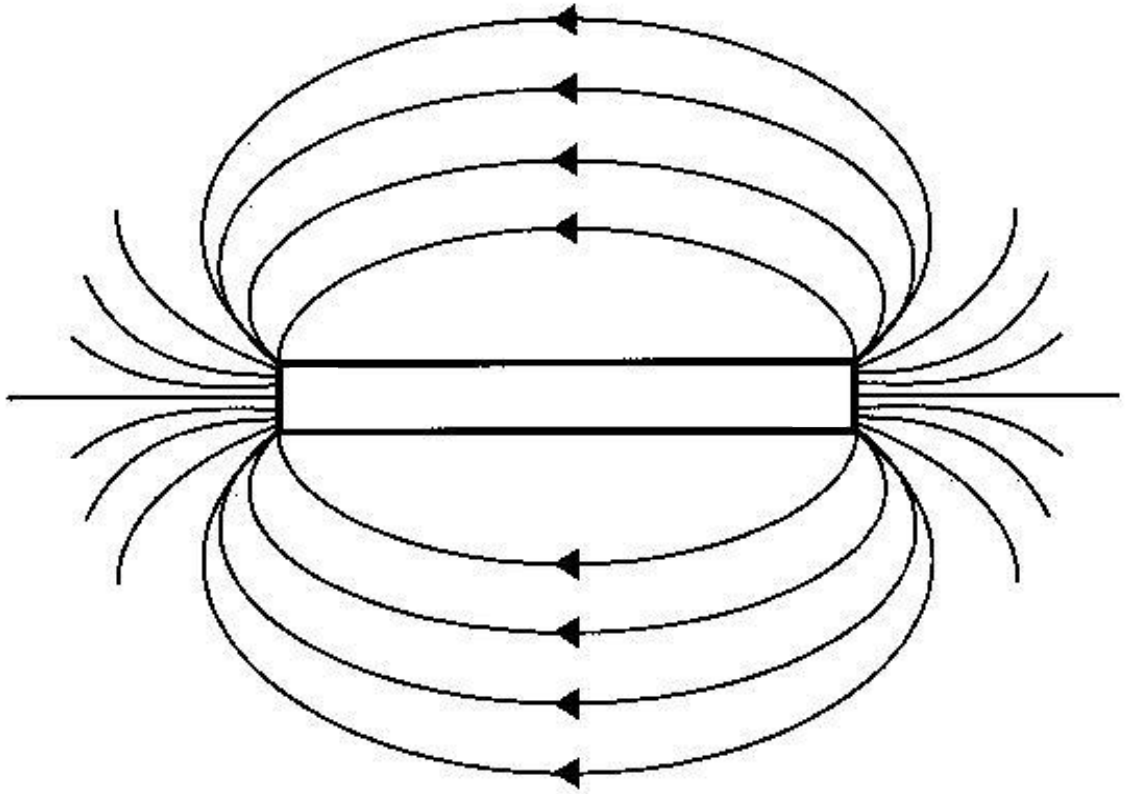
Why are these concepts important?

- Real world situations:
  - Motors
  - Transformers
  - Medical imaging
  - Loudspeakers
  - Trains
  - …

Background Knowledge

Magnetism

- Magnetic fields are produced by the alignment of magnetic moments of atoms



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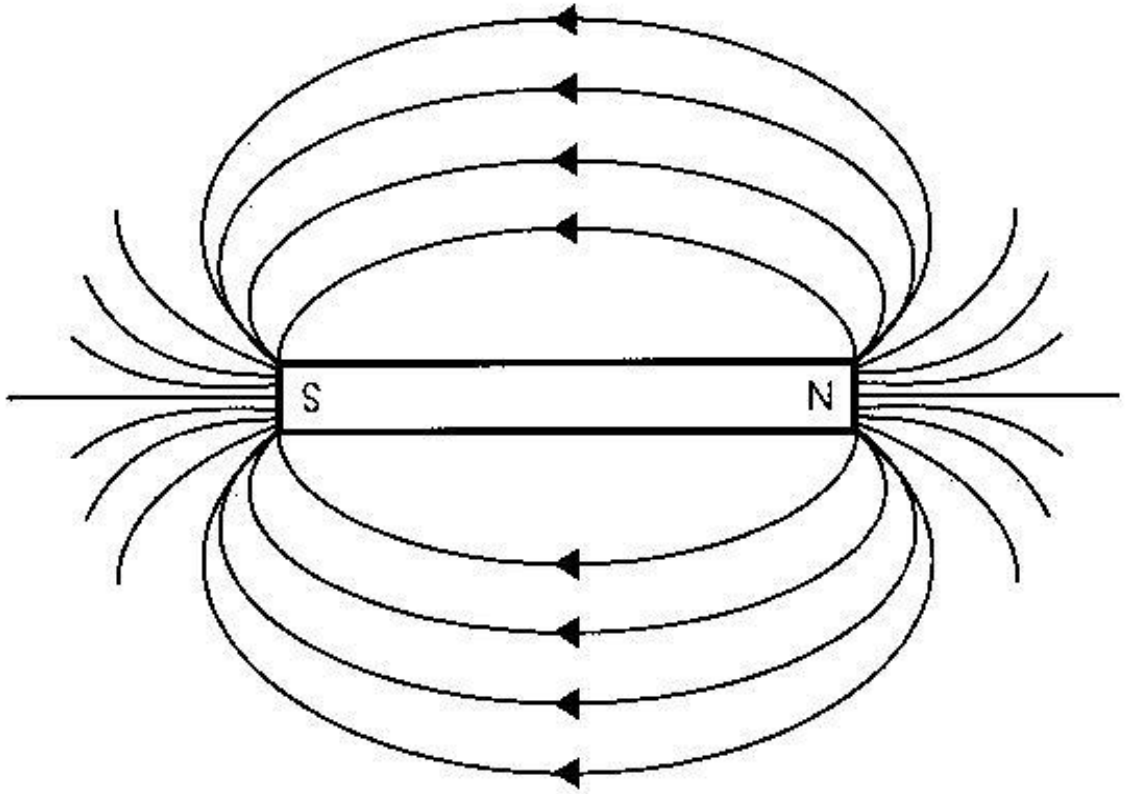
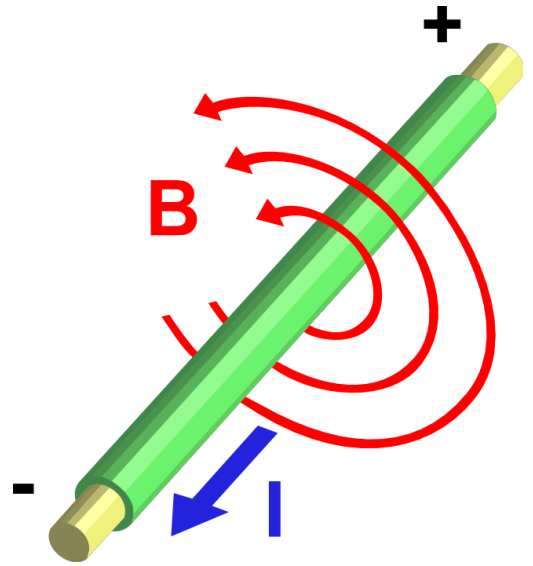


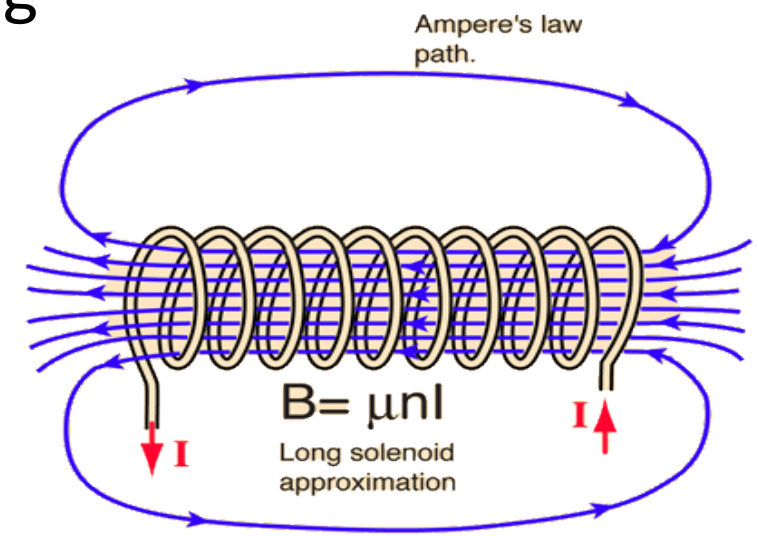
PHET simulation

Electromagnetism



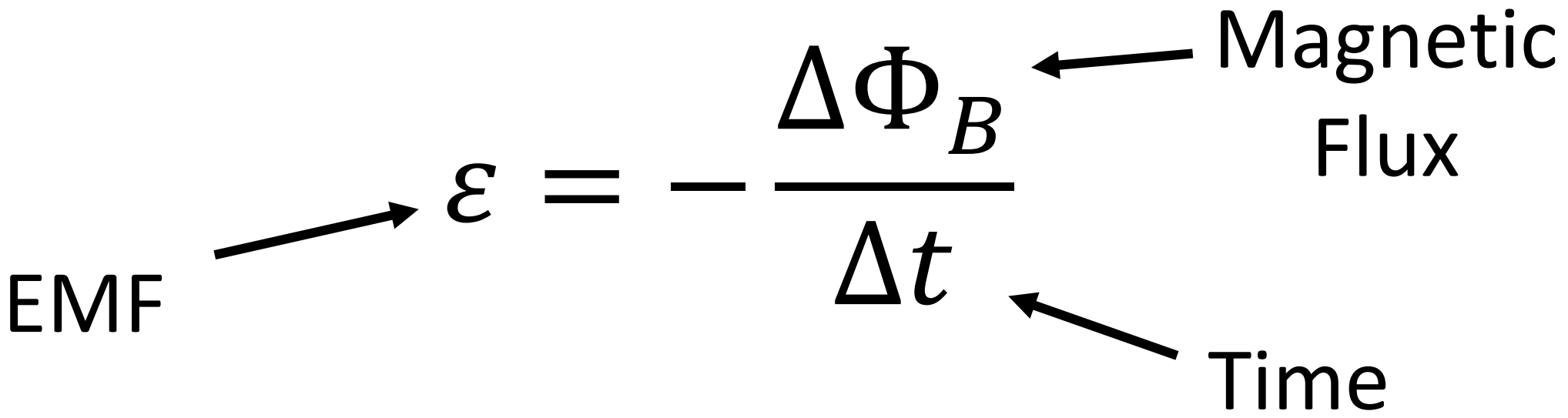
- A current carrying wire produces a magnetic field as defined by Ampere's Law

- If a metal such as iron is placed within a wrapping of this wire, then the induced magnetic field will align the domains within the metal



Faraday's Law

- A changing magnetic field will cause an electromotor force (EMF) to be induced:

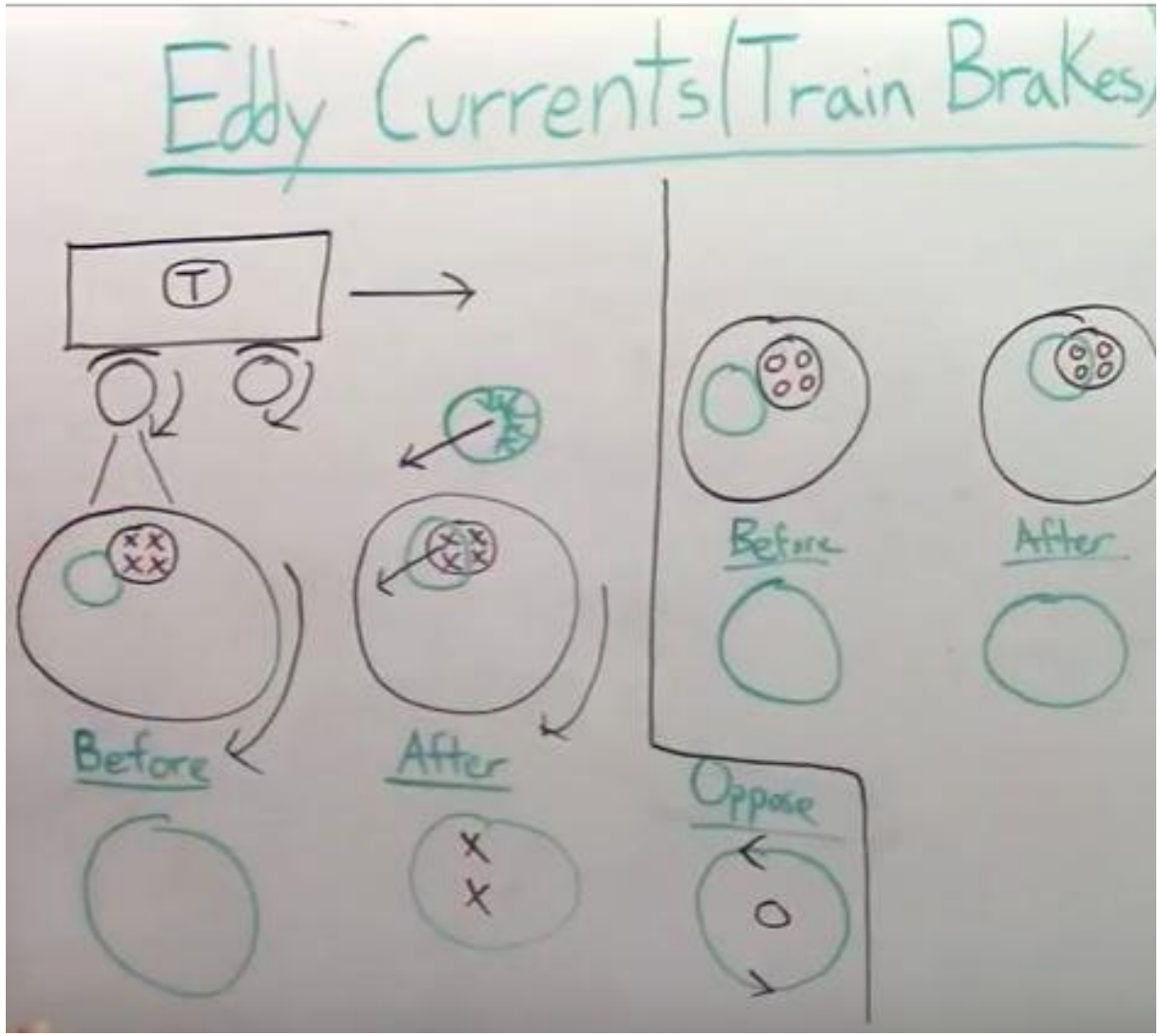


Lenz’s Law

- The direction of current induced in a conductor by a changing magnetic field due to Faraday's law of induction will be such that it will create a magnetic field that opposes the change that produced it.

PHET simulation

Eddy Current Brakes



Demo Time!!

Predictions

- The wheel will be spun to a speed of 30kmh and then left to slow down under three circumstances:

  - 0 voltage supplied to the electromagnet
  - ½ of max voltage supplied to the electromagnet
  - Max voltage supplied to the electromagnet

  Order these three conditions from shortest time to bring the wheel to a stop, to the longest time taken

Results

	Time taken for the wheel to come to rest		
Trial	0 Volts (seconds)	½ Max (seconds)	Max (seconds)
1			
2			
3			
Average			

Questions?