

Introduction to Physical Science

Electromagnetic Waves
Presented by Robert Wagner

Maxwell's Equations

- Maxwell's Equations - showed that electric and magnetic forces are really just different manifestations of the same thing
- Changing magnetic fields will produce electric fields and changing electric fields will produce magnetic fields
 - Predicted waves - electromagnetic waves would move at the speed of light
 - Light is an example of an electromagnetic wave
 - Other types now known - radio waves, ultraviolet, etc.

Maxwell's Equations

- Maxwell's Equations:
- Electric field lines originate on positive charges and end on negative charges
- Magnetic field lines are continuous - no beginning or end. Magnetic monopoles are not known to exist
- A changing magnetic field will produce an electric field
- Magnetic fields are generated by moving charges or changing electric fields

Production of Electromagnetic Waves

- Consider current in a long straight wire
- AC - alternative current
 - Electric field (E) produced by charge in the wire
 - Field changes as current changes and propagates outward
 - Corresponding magnetic field (B) propagates outward as well

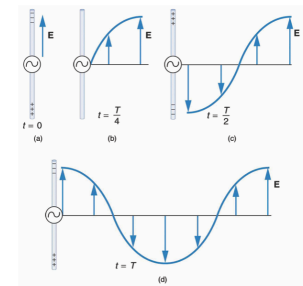


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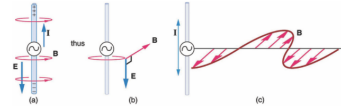


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Electromagnetic Waves

- Electric and magnetic fields propagate outward - perpendicular to each other - transverse wave
- Waves will propagate out in all directions
- Any accelerating charge will produce electromagnetic radiation
- Examples - Antennae produce and detect standing waves from radio/TV broadcasts

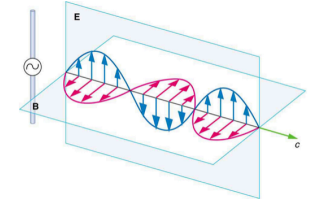


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Summary

- Maxwell's equations - show that the magnetic and electric forces are different manifestations of the same thing
- Electromagnetic waves are produced as charges move such as current in a wire
- Electromagnetic waves are produced by any accelerating charges