

CHAPTER OVERVIEW

21: The Magnetic Force

Learning Objectives

- Understand the key characteristics of a magnetic field and what makes it different from an electric field.
- Understand how to model the magnetic force on a moving charge.
- Understand how to model the magnetic force on a wire carrying current.
- Understand how to model the torque exerted on a current-carrying loop by a magnetic field.
- Understand how to model the Hall Effect.
- Understand simple applications of the magnetic force

This chapter introduces the tools to model the magnetic force, which is something that we have all experienced with magnets. As we will see, the magnetic force acts on moving (electric) charges, and is thus fundamentally different from the electric force which acts on stationary and moving charges. In later chapters, we will develop the tools that allow us to make connections between the electric and magnetic fields.

prelude

When you go through airport security, they sometimes sample your luggage with sticky tape and place that tape into a machine to detect trace amounts of explosives. How does that machine work?

1. The machine detects trace amounts by “sniffing” the sample using similar chemical reactions as those in our olfactory system.
2. The machine vaporizes the sample and accelerates the resulting charged vapour around a circle to determine its constituents.

[21.1: Magnetic fields](#)

[21.2: The magnetic force on a moving charge](#)

[21.3: The magnetic force on a current-carrying wire .](#)

[21.4: The Torque on a Current-Carrying Loop](#)

[21.5: The Hall Effect](#)

[21.6: Applications](#)

[21.7: Summary](#)

[21.8: Thinking about the Material](#)

[21.9: Sample problems and solutions](#)

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