PHYS 212, Honors Section – Review Material

Chapter 29: Magnetic Fields

- <u>Basic facts</u>: Attraction and repulsion; N and S magnetic poles; Magnetic vs non-magnetic materials.

- <u>Field lines</u>: Direction in which they point; Do they start and/or end anywhere?

- <u>Earth's magnetic field</u>: Qualitatively; The average value is about $0.5\ \text{G} = 5.0 \times 10^{-5}\ \text{T}$.

- <u>Magnetic force on a moving charge or current</u>: Given by, respectively,

$$\mathbf{F} = q\,\mathbf{v} \times \mathbf{B},\ \text{ or }\ F = |q|vB\,\sin\theta\ ,\ \text{ and }\ \mathbf{F} = I\,\mathbf{L} \times \mathbf{B},\ \text{ or }\ F = ILB\,\sin\theta\ .$$

  You can find the direction from the right-hand rule. The units of B are tesla, $1\ \text{T} = 1\ \text{N·s/C·m}$.

- <u>Hall effect</u>: Be able to describe qualitatively what happens and the origin of the Hall voltage.

- <u>Path of a particle</u>: In a constant magnetic field, a particle with velocity perpendicular to $\mathbf{B}$ moves on a circle with

$$r = mv/|q|B.$$

  What happens qualitatively to a particle whose velocity is not perpendicular to $\mathbf{B}$, or one moving in a non-constant magnetic field, such as the Earth's.

- <u>Torque on a current loop</u>: Qualitatively, what happens to a loop of current when placed in a magnetic field, and along what direction the loops tends to align itself; The magnetic dipole moment of the loop and the torque on it are given by

$$\boldsymbol{\tau} = \boldsymbol{\mu} \times \mathbf{B}\ ,\ \text{ with }\ \boldsymbol{\mu} = NI\mathbf{A}\ .$$

- [<u>Potential energy of a magnetic dipole</u>: Given by $U = -\boldsymbol{\mu} \cdot \mathbf{B}$.]

<u>Note</u>: You are not required to know the topics and equations inside square brackets.