

Physics 231: Electricity & Magnetism

Prof. Eyal Schwartz Spring 2027 MWF 11:00- 11:50 AM

Course Description

Electricity & magnetism is the study of how electric and magnetic phenomena are organized into a unified physical theory. Starting from experimental observations and empirical laws, the course develops the concepts of electric and magnetic fields and shows how they evolve in space and time. These ideas come together in Maxwell's equations, which reveal electricity and magnetism as two aspects of a single framework. A central theme of the course is the transition from forces between charges to fields as physical objects, governed by local laws. Principles such as superposition and symmetry play a key role in understanding how complex phenomena arise from simple building blocks. Maxwell's equations also predict the existence of electromagnetic waves, identifying light itself as an electromagnetic phenomenon. By the end of the course, you will see how a small set of principles and equations accounts for a wide range of phenomena governing our everyday lives, and why electromagnetism occupies a central place in the development of modern physics.

Topics include:

- Fields: what are they and why do we need them?
- Electrostatic force, field, potential and energy.
- Capacitance and dielectric materials.
- DC currents and circuits.
- Magnetostatics, magnetic materials.
- Electrodynamics, Maxwell's equations and EM waves.

