In this unit, you will explore the electrostatic potential $V(\vec{r})$ (and the gravitational potential $\Phi(\vec{r})$) and the electric field $\vec{E}(\vec{r})$ due to continuous sources in 1-, 2-, and 3-dimensions and in rectangular, cylindrical, and curvilinear coordinates.

How do these fields vary in space? How do equipotential surfaces and the superposition principle help you answer these questions graphically? How do the values of these field fall-off as you move away from the charges? How do power series approximations help you answer these questions algebraically?

Key Activities/Problems

- Electrostatic Potential Due to a Ring of Charge
- Constants, Variables, and Parameters
- Potential Due to a Ring of Charge–Limiting Cases
- Multipole Expansions
- Electric Field Due to a Ring of Charge

At the end of this unit, you should be able to:

- Find an integral expression for the electric (or gravitational) potential and the electric field from a continuous source.
- Recognize that you cannot perform an integral with a vector-valued integrand and have a strategy for handling the situation.
- Recognize the difference between constants, parameters, and variables and know how these identifications can change while doing a complicated problem.
- Do a power series expansion of the integrand in an integral expression for these fields so that you can integrate term-by-term.