Lecture 7, Jan 23, 2023

Field Computation Using Gauss's Law

- Using Gauss's law we can solve for the field from the charge distribution, but only if we know the nature of the field beforehand
- We have to make two assumptions:
    1. What components does the field have?
    2. How does the field magnitude change with space? (i.e. Which variables is it a function of?)
- From these questions we can determine the different regions we have to evaluate Gauss's law on and what kind of Gaussian surface is needed
    - A *Gaussian surface* is an imaginary surface on which we find the flux
    - We must choose the Gaussian surface wisely to make questions solvable at all; to do this we need to make use of symmetry
- In order of bring $\vec{D}$ out of the flux integral $\oiint_S \vec{D} \cdot \mathrm{d}\vec{S} = Q_{enc}$, we need:
    1. S has to be closed
    2. S has to be oriented such that $\vec{D} \cdot \mathrm{d}\vec{S} = 0$ or $D \, \mathrm{d}S$
    3. Over points where $\vec{D} \cdot \mathrm{d}\vec{S} = D \, \mathrm{d}S$, $\|\vec{D}\|$ should be constant