Electric Field

A field is a physical quantity that can be specified at each point in a given region of space.

Example: Measuring water in a pipe. Each point has a velocity, or...
**Example: Electric Dipole**

Consider a change in the position of charges.

\[ \mathbf{E} = \mathbf{E}_1 + \mathbf{E}_2 \]

\[ \mathbf{E}_1 = \mathbf{E}_0 \]

\[ \mathbf{E}_2 = \mathbf{E}_0 \]

\[ \mathbf{E} = \mathbf{E}_0 + \mathbf{E}_0 = 2\mathbf{E}_0 \]

Since \( \mathbf{E}_1 \) and \( \mathbf{E}_2 \) are parallel, the net electric field is twice \( \mathbf{E}_0 \).

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**E = \frac{q}{4\pi\epsilon_0 r^2}**

- If \( q \) is positive, \( \mathbf{E} \) is directed away from the charge.
- If \( q \) is negative, \( \mathbf{E} \) is directed towards the charge.

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**\( \mathbf{E} = \mathbf{E}_0 \)**

- **Point 1:** \( x = \frac{1}{2} \)
- **Point 2:** \( x = \frac{3}{2} \)

\[ E = \mathbf{E}_0 \cos \left( \frac{2\pi x}{a} \right) \]

- **Point P:** \( x = \frac{3}{2} \)

\[ E = \mathbf{E}_0 \cos \left( \frac{2\pi \times \frac{3}{2}}{a} \right) = \mathbf{E}_0 \cos \left( \frac{3\pi}{a} \right) \]

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**For a dipole, the charges do not cancel**

- Because 2 charges are more useful distance.