Electrodynamics

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- Current
  - Ohm's "Law"[1]
    - Holds when there is some current density such that $\vec{J} = \sigma\vec{E}$, with σ as conductivity
    - The unit of conductivity is $\left[\frac{\text{A}}{\text{V m}}\right]$
    - The resistivity is the inverse of the conductivity, $\rho = \sigma^{-1}$, with units $[\Omega\,\text{m}]$[2]
  - The average velocity of a particle accelerated over an interval due to an electric field is:

$$v_{avg} = \sqrt{\frac{q\vec{E}d}{2m}}$$

  - The current density can be defined as

$$\vec{J} = nq\vec{v}$$

  - An electron's drift velocity may be defined as:

$$v_d = \frac{1}{2}\frac{q\vec{E}d}{mv}$$

    - As long as $v_d << v$
  - Given a wire of length L and potential V_o, we can calculate:

$$\vec{E} = \frac{V_o}{L}$$

$$R = \frac{V}{I} = \frac{\vec{E}L}{\vec{J}A} = \frac{\rho L}{A}$$

[1] Note: this is not a fundamental law
[2] Note: Ohms are equal to $\frac{\text{V}}{\text{A}}$