

Parameter standardization

Definition

c : lightspeed

$$m = m_e m^*$$

$$q = q_e q^*$$

$$\Omega_e = \frac{q_e}{m_e} B_{eq} : \text{Electron cyclotron frequency}$$

$$v = c v^*$$

$$x = c \Omega_e^{-1} x^*$$

$$\vec{B} = B_{eq} \vec{B}^*$$

$$\vec{E} = c B_{eq} \vec{E}^*$$

$$t = \Omega_e^{-1} t^*$$

so,

$$\frac{dx}{dt} = v = c v^*$$

$$\frac{d(c \Omega_e^{-1} x^*)}{d(\Omega_e^{-1} t^*)} = c v^*$$

$$c \frac{dx^*}{dt^*} = c v^*$$

$$\frac{dx^*}{dt^*} = v^*$$

$$\frac{dv}{dt} = \frac{q}{m} (\vec{E} + \vec{v} \times \vec{B})$$

$$\frac{dv}{dt} = \frac{d(c v^*)}{d(\Omega_e^{-1} t^*)} = c \Omega_e \frac{dv^*}{dt^*}$$

$$c \Omega_e \frac{dv^*}{dt^*} = \frac{q}{m} (\vec{E} + \vec{v} \times \vec{B})$$

$$\frac{dv^*}{dt^*} = \frac{m_e}{c q_e B_{eq}} \frac{q}{m} (\vec{E} + \vec{v} \times \vec{B})$$

$$\frac{dv^*}{dt^*} = \frac{q^*}{m^*} (\vec{E}^* + \vec{v}^* \times \vec{B}^*)$$