$$\underline{\underline{\Lambda}}_x = \begin{pmatrix} \gamma & -\beta\gamma & & \\ -\beta\gamma & \gamma & & \\ & & 1 & \\ & & & 1 \end{pmatrix}, \quad \underline{\underline{\Lambda}}_y = \begin{pmatrix} \gamma & & -\beta\gamma & \\ & 1 & & \\ -\beta\gamma & & \gamma & \\ & & & 1 \end{pmatrix}, \quad \underline{\underline{\Lambda}}_z = \begin{pmatrix} \gamma & & & -\beta\gamma \\ & 1 & & \\ & & 1 & \\ -\beta\gamma & & & \gamma \end{pmatrix} \quad \text{LTs}$$

$$\underline{\underline{\Lambda}}_x^{-1} = \begin{pmatrix} \gamma & \beta\gamma & & \\ \beta\gamma & \gamma & & \\ & & 1 & \\ & & & 1 \end{pmatrix}, \quad \underline{\underline{\Lambda}}_y^{-1} = \begin{pmatrix} \gamma & & \beta\gamma & \\ & 1 & & \\ \beta\gamma & & \gamma & \\ & & & 1 \end{pmatrix}, \quad \underline{\underline{\Lambda}}_z^{-1} = \begin{pmatrix} \gamma & & & \beta\gamma \\ & 1 & & \\ & & 1 & \\ \beta\gamma & & & \gamma \end{pmatrix} \quad \text{inverse LTs}$$

$$\underline{J} = \rho \underline{v} \qquad c = \frac{1}{\sqrt{\varepsilon_0 \mu_0}}$$

$$\begin{cases} \underline{B} = \nabla \times \underline{A} \\ \underline{E} = -\partial_t \underline{A} - \nabla \phi \end{cases} \quad \text{with gauge invariance} \quad \begin{cases} \underline{A} \to \underline{A} + \nabla \lambda \\ \phi \to \phi - \partial_t \lambda \end{cases} \qquad \lambda(\underline{x}, t)$$

$$\underline{a}_R = \underline{a}_I \underbrace{- 2\underline{\omega} \times \underline{v}_R}_{\text{coriolis}} \underbrace{- \underline{\omega} \times (\underline{\omega} \times \underline{r})}_{\text{centrifugal}} \quad \text{with Earth basis} \quad \begin{matrix} \hat{\underline{i}} = \text{east} \\ \hat{\underline{j}} = \text{north} \\ \hat{\underline{k}} = \text{up} \end{matrix} \Rightarrow \underline{\Omega} = \begin{pmatrix} 0 \\ \Omega \sin\theta \\ \Omega \cos\theta \end{pmatrix} \quad \text{polar}$$

$$\frac{d}{dt}\left(\frac{\partial L}{\partial \dot{q}_i}\right) = \frac{\partial L}{\partial q_i}$$

$$p_i = \frac{\partial L}{\partial \dot{q}_i} \Rightarrow \dot{q}_i = \dot{q}_i(q, p)$$

$$H(q, p) = \sum_i p_i \dot{q}_i - L$$

$$\begin{cases} \dot{q}_i = \dfrac{\partial H}{\partial p_i} \\ \dot{p}_i = -\dfrac{\partial H}{\partial q_i} \end{cases} \quad \text{with } \{F, H\} = \sum_i \left(\frac{\partial F}{\partial q_i}\frac{\partial H}{\partial p_i} - \frac{\partial F}{\partial p_i}\frac{\partial H}{\partial q_i}\right)$$

Moving charge following $\underline{r}_0(t)$:

$$\rho(\underline{r}, t) = q\, \delta^3(\underline{r} - \underline{r}_0(t))$$

$$\underline{J}(\underline{r}, t) = q\, \underline{v}_0(t)\, \delta^3(\underline{r} - \underline{r}_0(t))$$