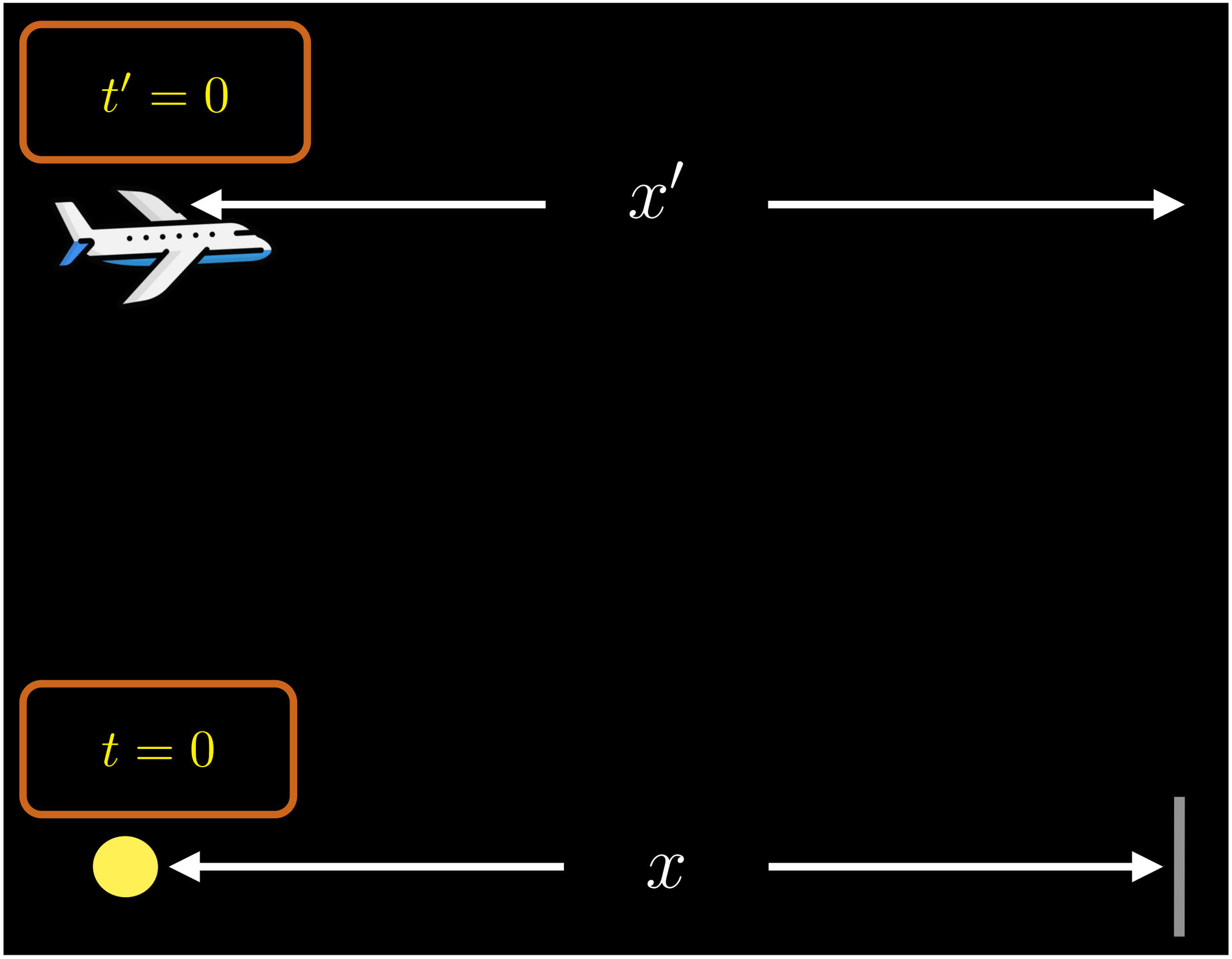
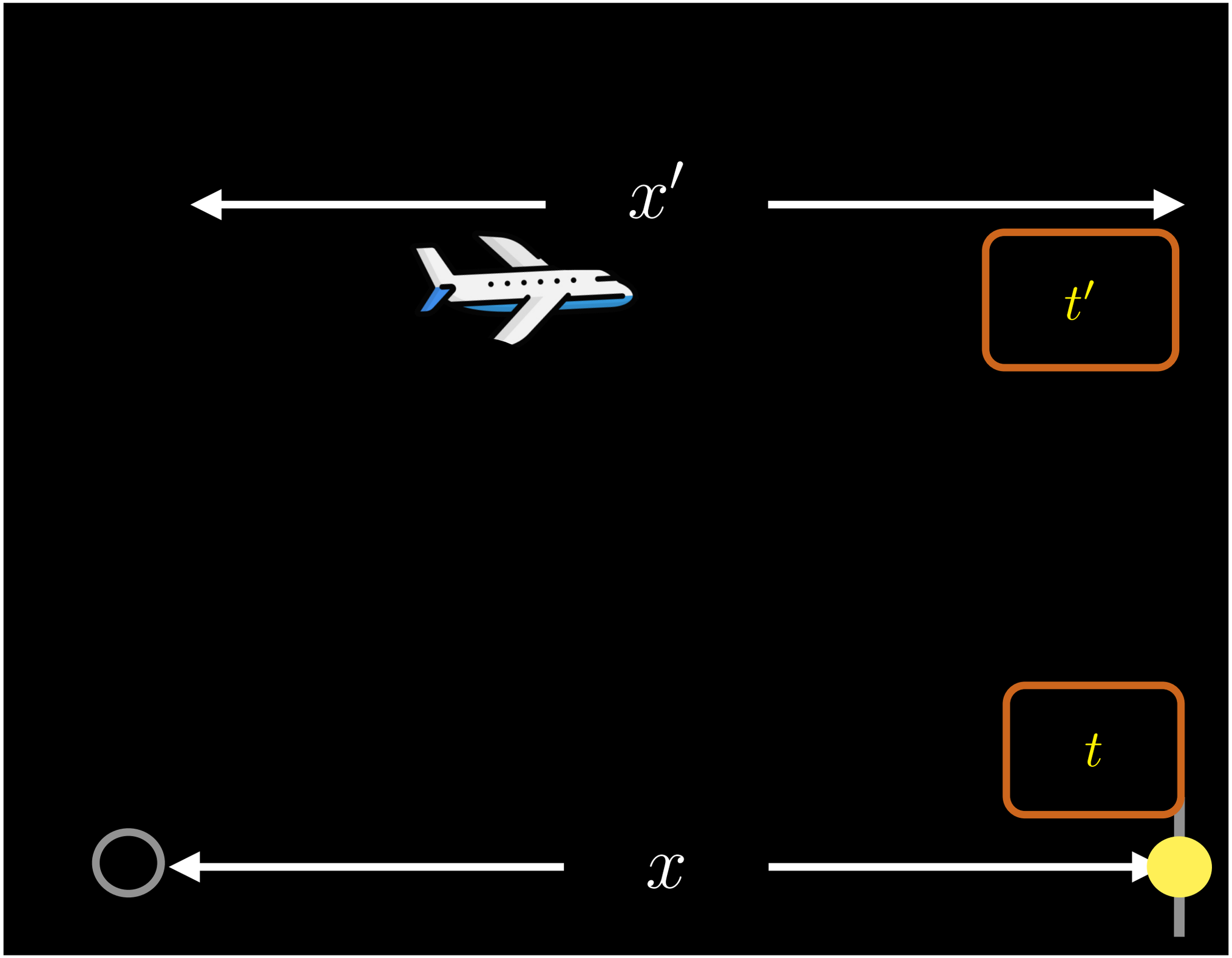
Eletromagnetismo Avançado

2 de outubro
Relatividade restrita

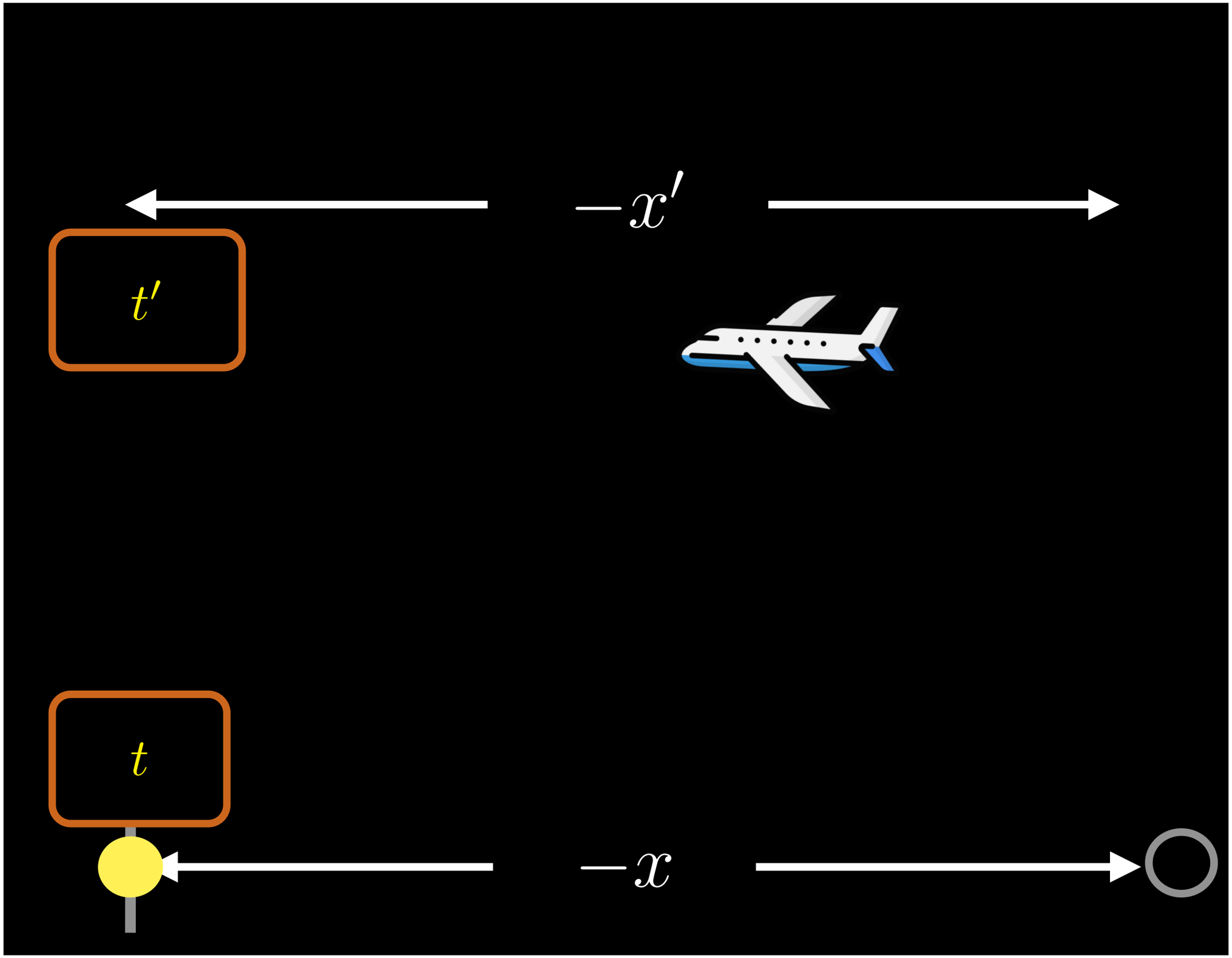
Transformação de Lorentz



Transformação de Lorentz



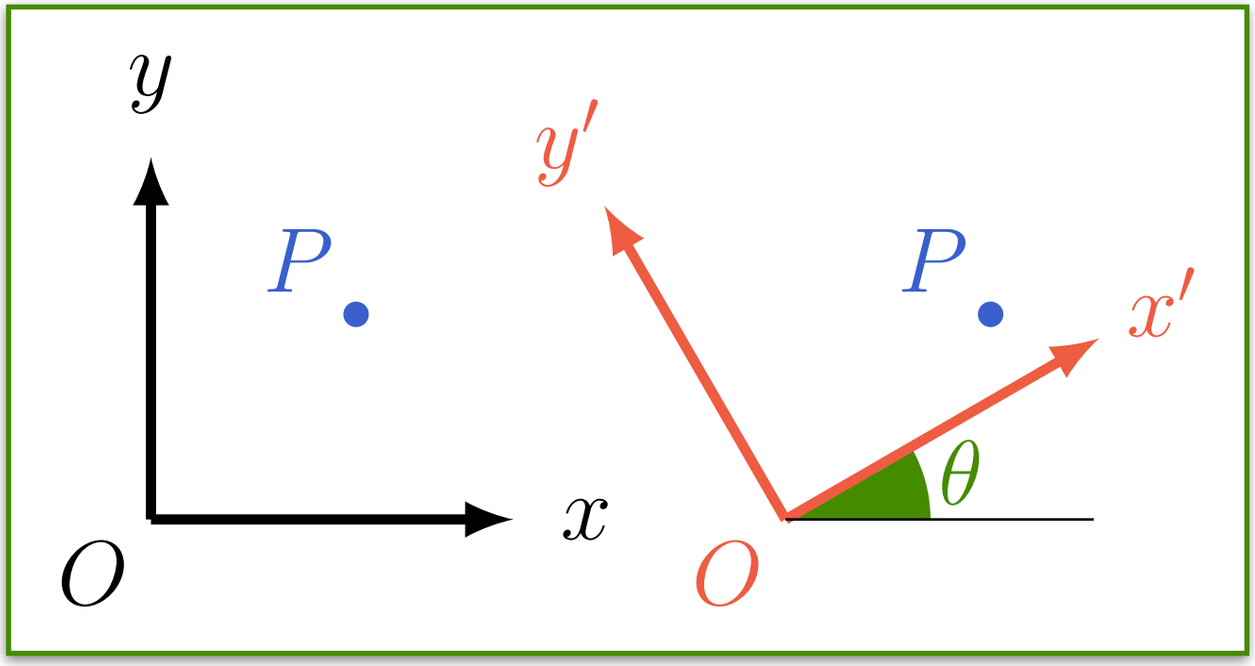
Transformação de Lorentz



Transformação de Lorentz

Mudança de coordenadas:

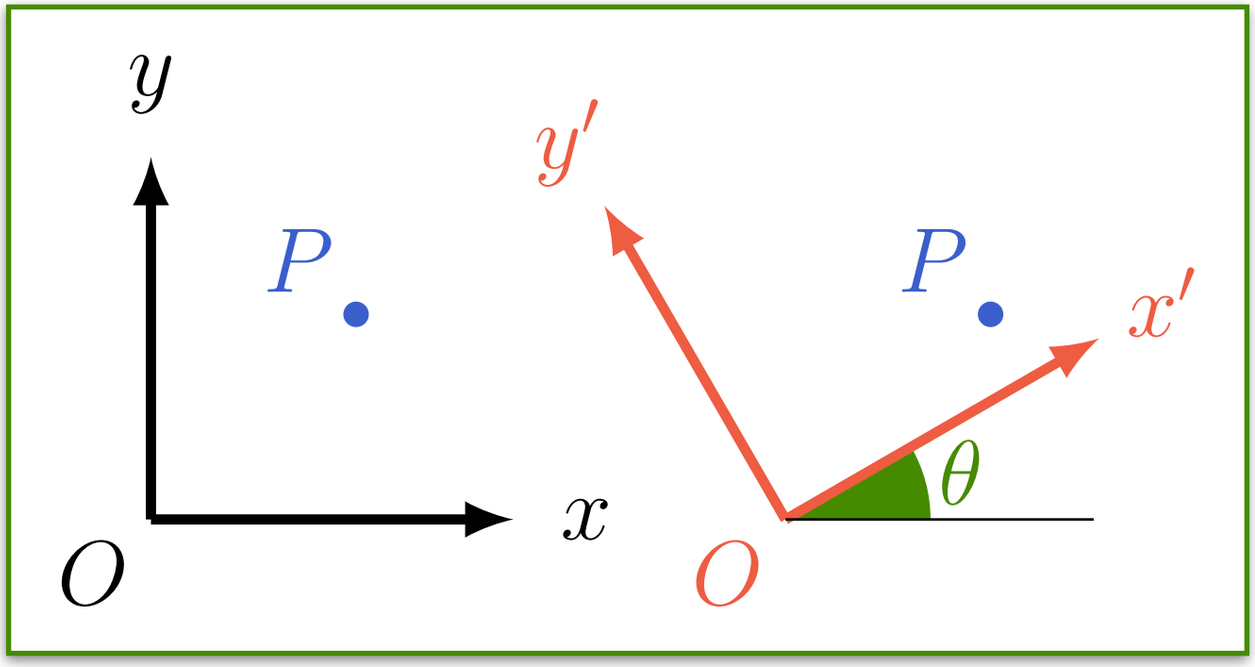
Rotação espacial



$$\begin{bmatrix} y' \\ x' \end{bmatrix} = \begin{bmatrix} \cos\theta & -\sin\theta \\ \sin\theta & \cos\theta \end{bmatrix} \begin{bmatrix} y \\ x \end{bmatrix}$$

Transformação de Lorentz

Mudança de coordenadas:



Rotação espacial

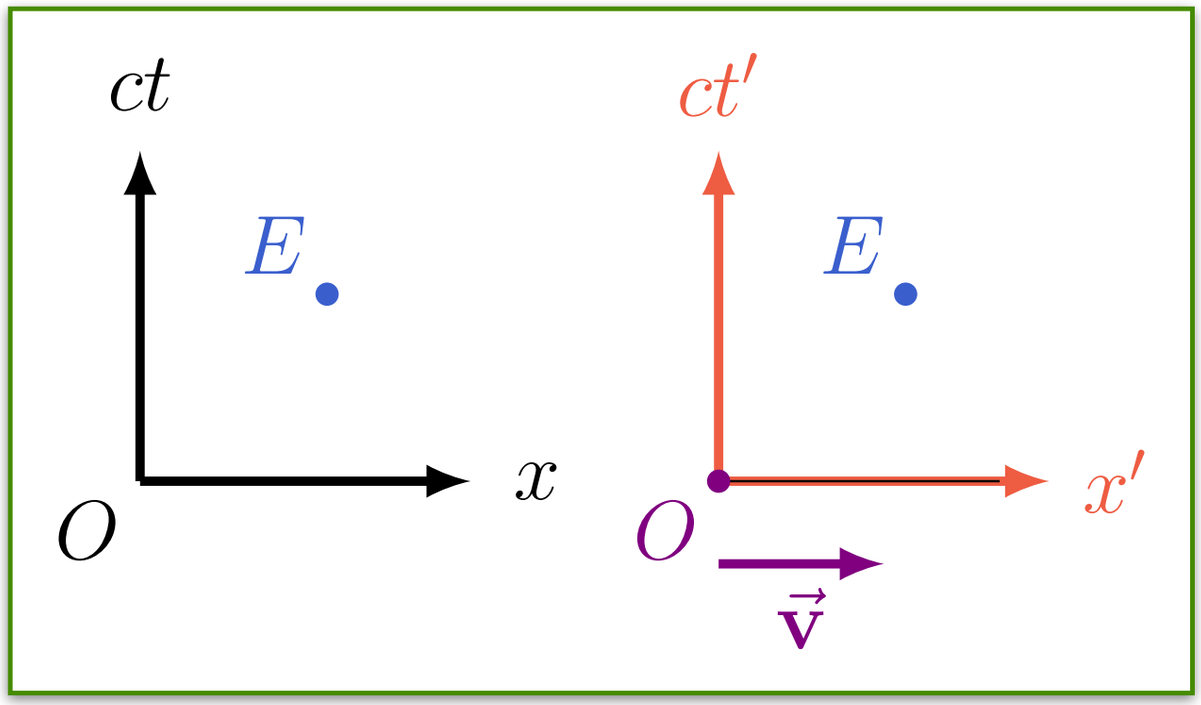
$$\begin{bmatrix} y' \\ x' \end{bmatrix} = \begin{bmatrix} \cos\theta & -\sin\theta \\ \sin\theta & \cos\theta \end{bmatrix} \begin{bmatrix} y \\ x \end{bmatrix}$$

$$x'^2 + y'^2 = x^2 + y^2$$

Transformação de Lorentz

Mudança de coordenadas:

Rotação espaço-temporal

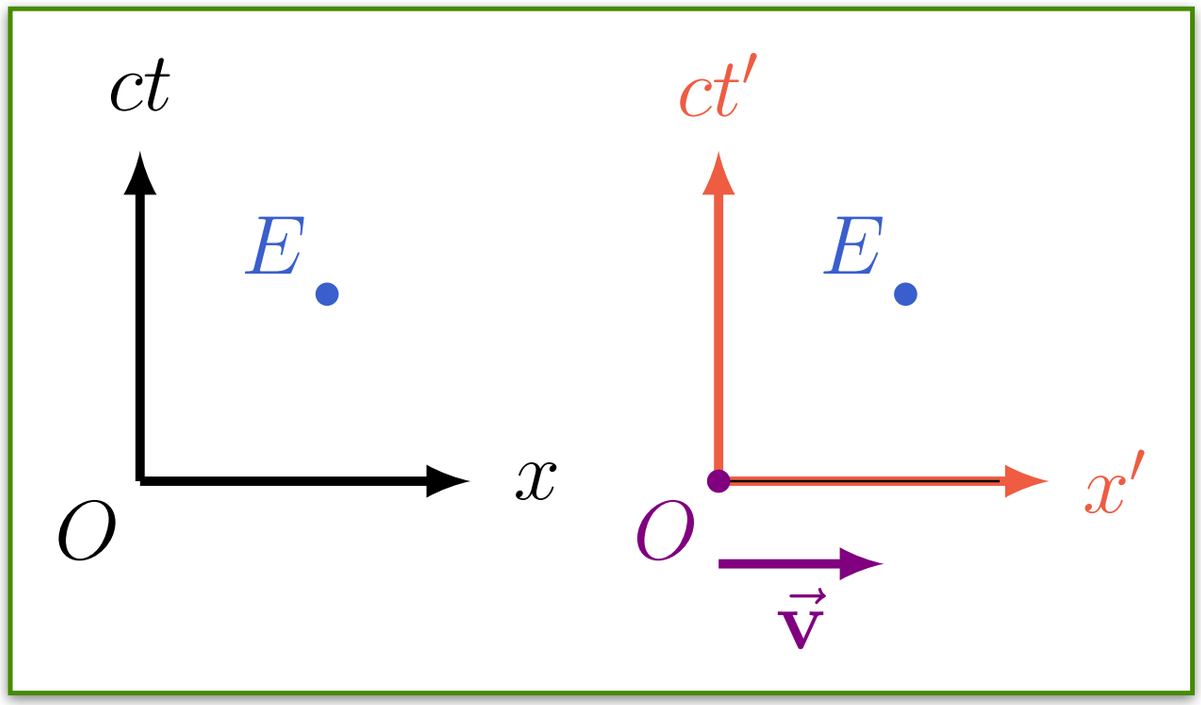


¿ $\begin{bmatrix} ct' \\ x' \end{bmatrix} = \begin{bmatrix} \cos\alpha & -\sin\alpha \\ \sin\alpha & \cos\alpha \end{bmatrix} \begin{bmatrix} ct \\ x \end{bmatrix}$?

Transformação de Lorentz

Mudança de coordenadas:

Rotação espaço-temporal



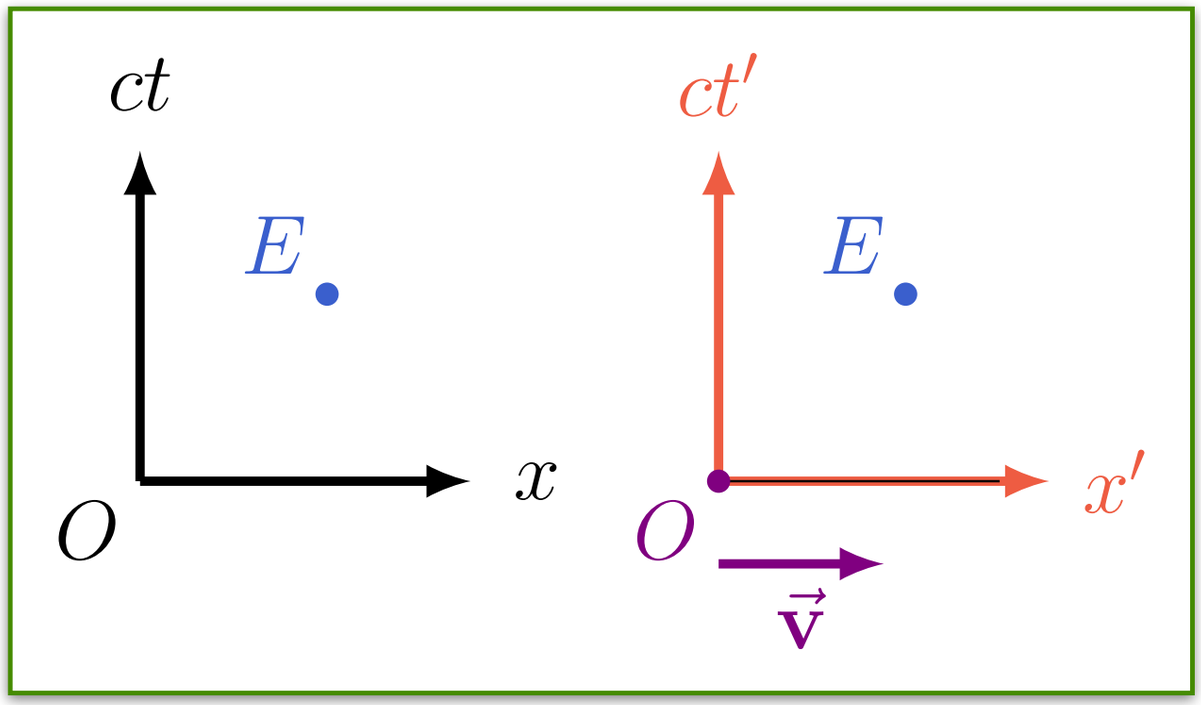
¿ $\begin{bmatrix} ct' \\ x' \end{bmatrix} = \begin{bmatrix} \cos\alpha & -\sin\alpha \\ \sin\alpha & \cos\alpha \end{bmatrix} \begin{bmatrix} ct \\ x \end{bmatrix}$?

$\Rightarrow \quad c^2t'^2 + x'^2 = c^2t^2 + x^2$ 😖

Transformação de Lorentz

Mudança de coordenadas:

Rotação espaço-temporal

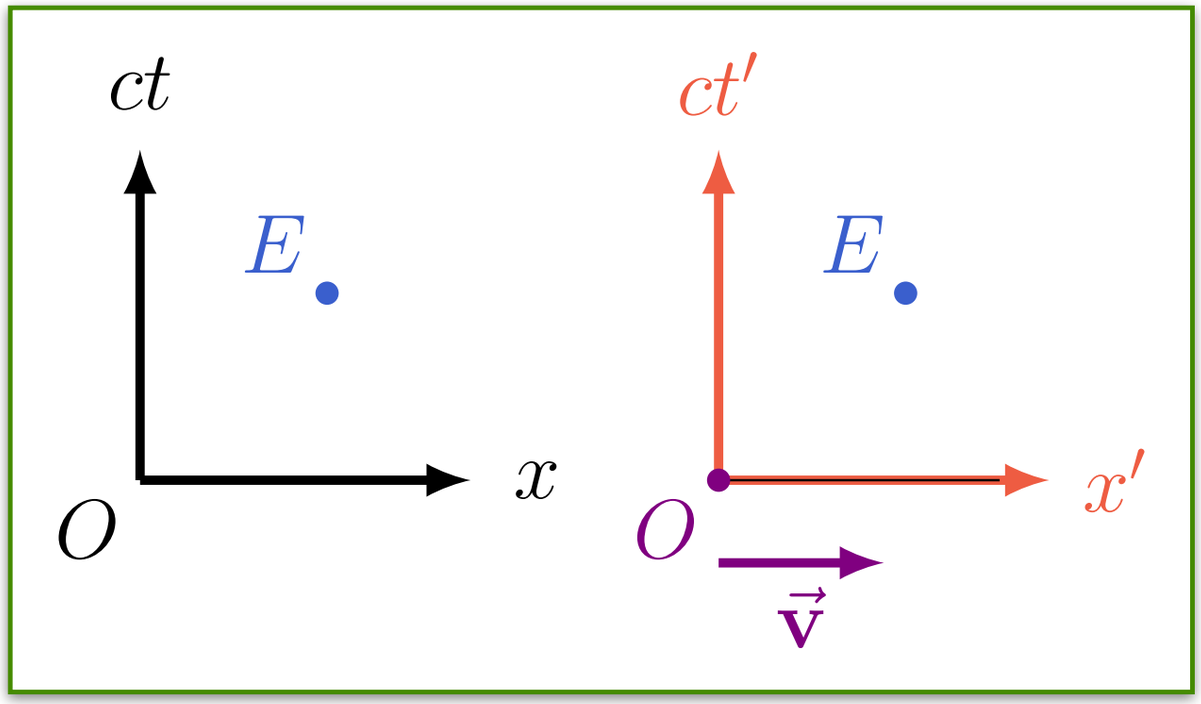


$$\begin{bmatrix} ct \\ x \end{bmatrix} \rightarrow \begin{bmatrix} ict \\ x \end{bmatrix}$$

$$c^2t'^2 + x'^2 = c^2t^2 + x^2 \quad \rightarrow \quad -c^2t'^2 + x'^2 = -c^2t^2 + x^2$$

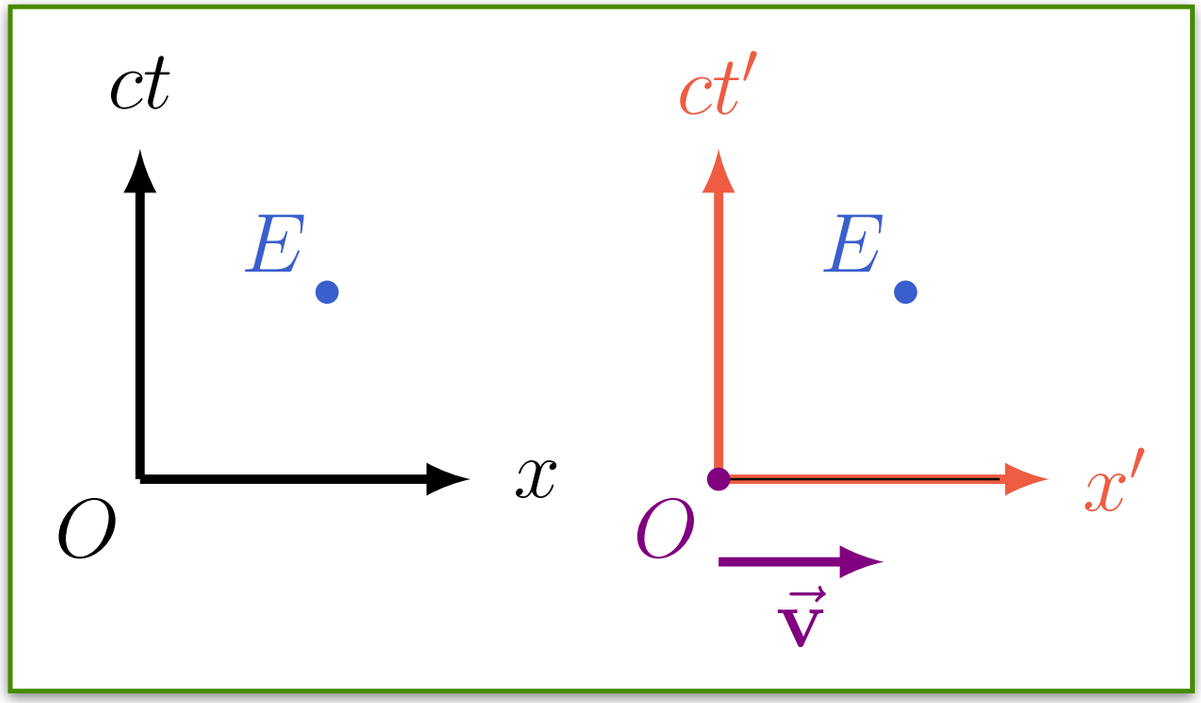
😃

Transformação de Lorentz



$$\begin{bmatrix} ict' \\ x' \end{bmatrix} = \begin{bmatrix} \cos\alpha & -\sin\alpha \\ \sin\alpha & \cos\alpha \end{bmatrix} \begin{bmatrix} ict \\ x \end{bmatrix}$$

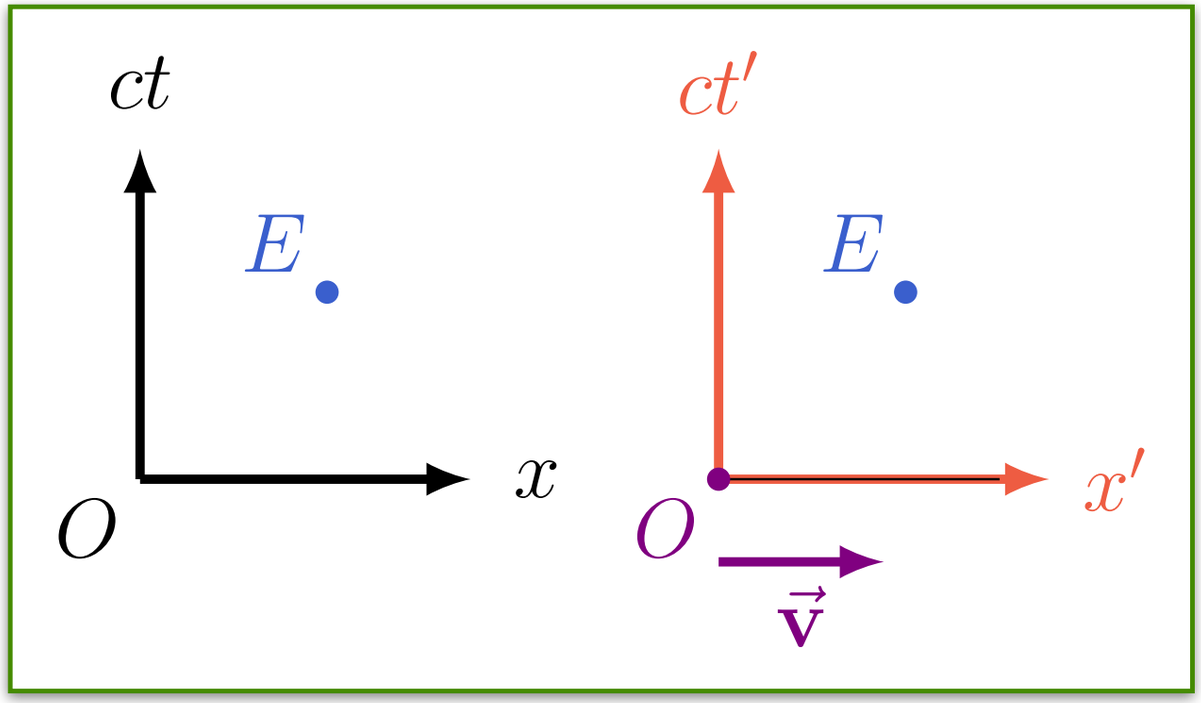
Transformação de Lorentz



$$\begin{bmatrix} ict' \\ x' \end{bmatrix} = \begin{bmatrix} \cos\alpha & -\sin\alpha \\ \sin\alpha & \cos\alpha \end{bmatrix} \begin{bmatrix} ict \\ x \end{bmatrix}$$

$$x = vt \quad \Rightarrow \quad x' = 0$$

Transformação de Lorentz



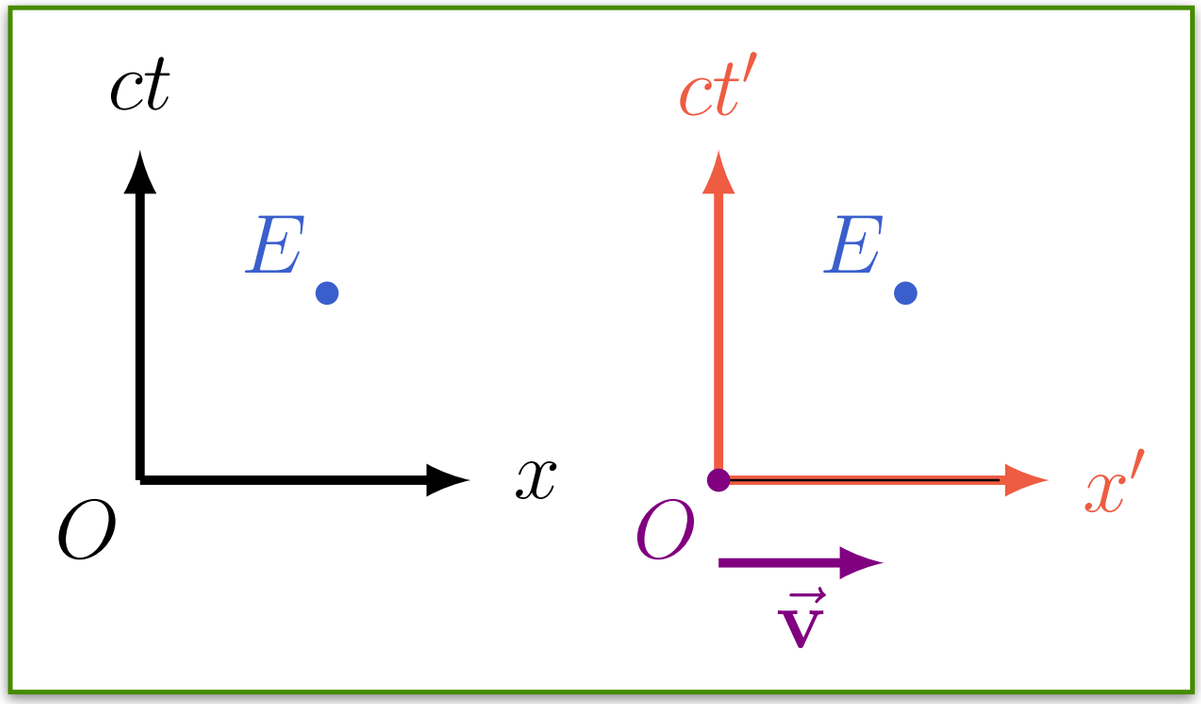
$$\begin{bmatrix} ict' \\ x' \end{bmatrix} = \begin{bmatrix} \cos\alpha & -\sin\alpha \\ \sin\alpha & \cos\alpha \end{bmatrix} \begin{bmatrix} ict \\ x \end{bmatrix}$$

$$x = vt \quad \Rightarrow \quad x' = 0$$

$$ict' = ict\cos\alpha - vt\sin\alpha$$

$$0 = ict\sin\alpha + vt\cos\alpha$$

Transformação de Lorentz



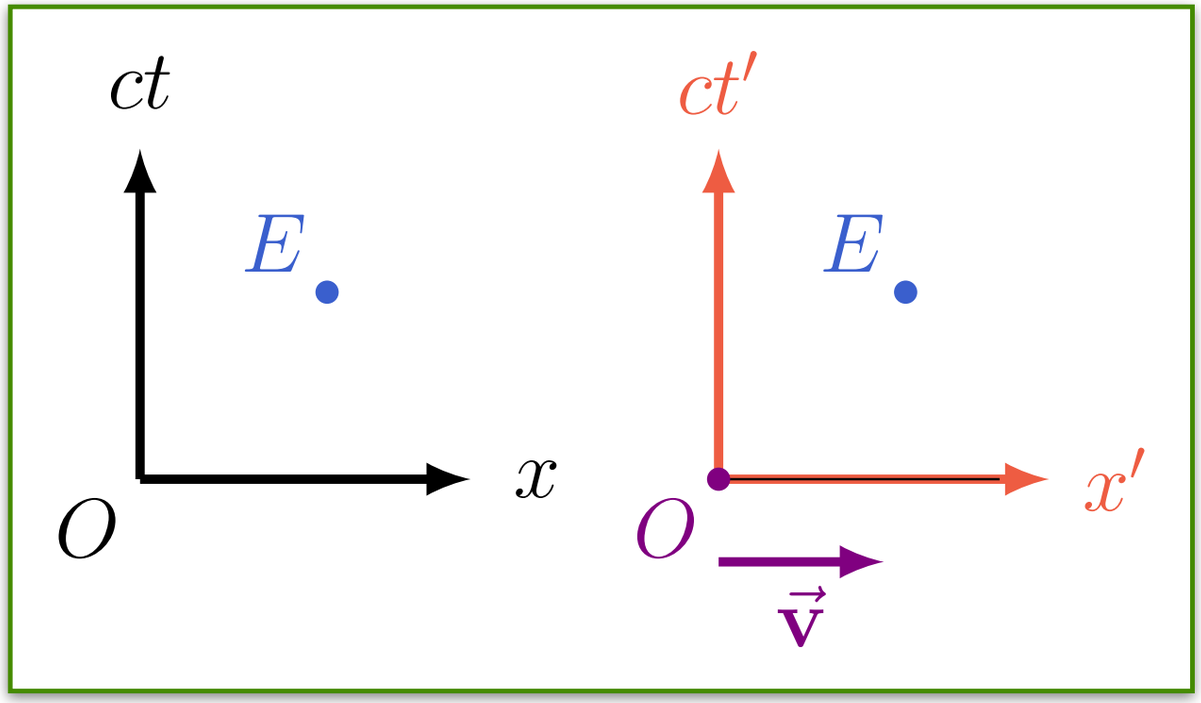
$$\begin{bmatrix} ict' \\ x' \end{bmatrix} = \begin{bmatrix} \cos\alpha & -\sin\alpha \\ \sin\alpha & \cos\alpha \end{bmatrix} \begin{bmatrix} ict \\ x \end{bmatrix}$$

$$x = 0 \quad \Rightarrow \quad x' = vt'$$

$$\sin\alpha = i\frac{v}{c}\cos\alpha$$

$$\tan\alpha = i\beta$$

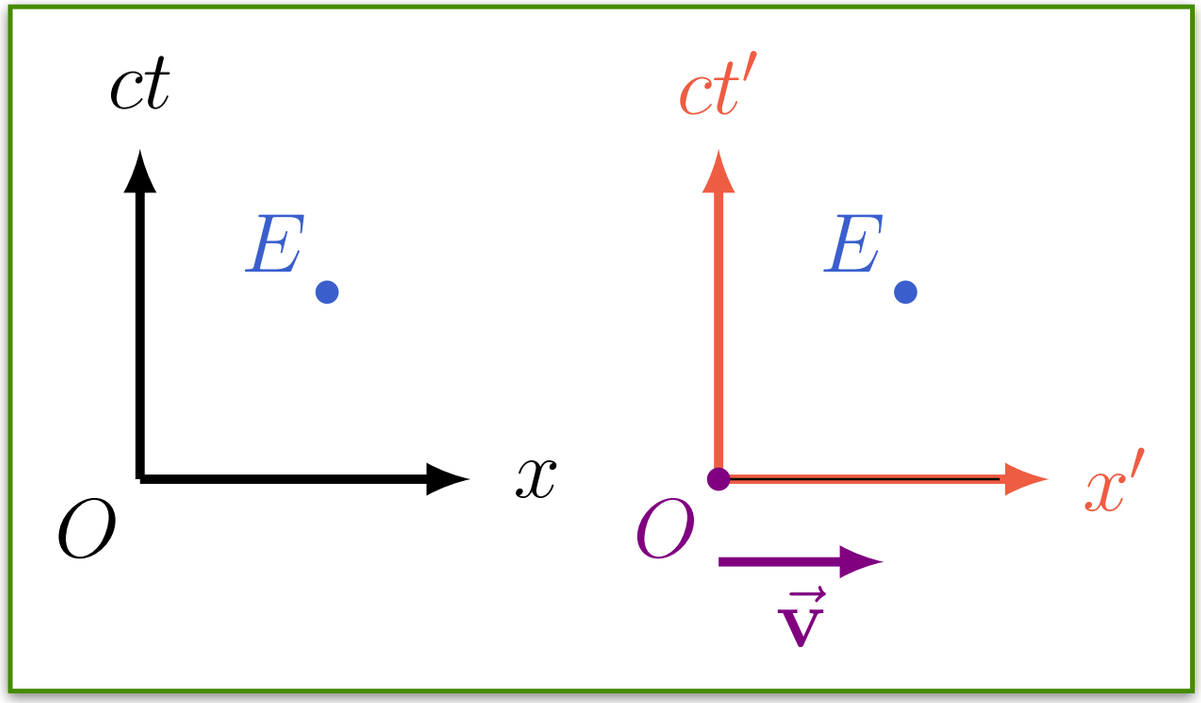
Transformação de Lorentz



$$\begin{bmatrix} ct' \\ x' \end{bmatrix} = \begin{bmatrix} \gamma & -\beta\gamma \\ -\beta\gamma & \gamma \end{bmatrix} \begin{bmatrix} ct \\ x \end{bmatrix}$$

$$\beta \equiv \frac{v}{c} \qquad \gamma \equiv \frac{1}{\sqrt{1-\beta^2}}$$

Transformação de Lorentz



3D

$$\begin{bmatrix} ct' \\ x' \\ y' \\ z' \end{bmatrix} = \begin{bmatrix} \gamma & -\beta\gamma & 0 & 0 \\ -\beta\gamma & \gamma & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} ct \\ x \\ y \\ z \end{bmatrix}$$