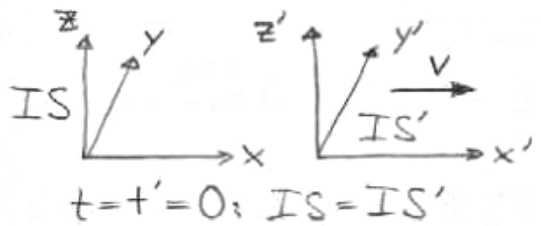


# Lorentztrafo für „boost“ in x-Richtung



allg. lineare Trafo:  

$$\begin{pmatrix} ct' \\ x' \end{pmatrix} = \begin{pmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{pmatrix} \begin{pmatrix} ct \\ x \end{pmatrix} \quad (7.31)$$

(i) Ursprung  $x'=0$  in IS:  $x \stackrel{(7.31)}{=} -\frac{a_{21}}{a_{22}} ct \stackrel{!}{=} vt$

$\rightarrow v = -\frac{a_{21}}{a_{22}} c \quad (1)$   
 $\stackrel{(7.31)}{\rightarrow} x' = a_{22} (x - vt) \quad (2)$

(ii) Ursprung  $x=0$  in IS':  $ct' \stackrel{(7.31)}{=} a_{11} ct$   
 $x' = a_{21} ct$   
 $= \frac{a_{21}}{a_{11}} ct' \stackrel{!}{=} -vt'$

$\rightarrow v = -\frac{a_{21}}{a_{11}} c \quad (3)$

$(1)=(3) \rightarrow a_{11} = a_{22} \quad (4)$

$\stackrel{(7.31)}{\rightarrow} ct' = a_{22} \left( ct + \frac{a_{12}}{a_{22}} x \right) \quad (5)$

(iii) (2) und (5) in

$$-(ct)^2 + x^2 \stackrel{(7.31)}{=} -(ct')^2 + x'^2 = 1$$

$$= - \underbrace{\left( a_{22}^2 - a_{22}^2 \frac{v^2}{c^2} \right)}_{=1} (ct)^2 + \underbrace{\left( -a_{12}^2 + a_{22}^2 \right)}_{=1} x^2 + \underbrace{\left( -a_{22} a_{12} - a_{22}^2 \frac{v}{c} \right)}_{=0} 2xct$$

$\rightarrow a_{22}^2 \left( 1 - \frac{v^2}{c^2} \right) = 1$

$\rightarrow a_{22} = \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}}$   
 $\rightarrow a_{12} = -a_{22} \frac{v}{c} \rightarrow a_{12} = -\frac{v/c}{\sqrt{1 - \frac{v^2}{c^2}}}$  } in (2) & (5)

$\rightarrow$  
$$\begin{aligned} x' &= \gamma (x - \beta ct) \\ ct' &= \gamma (ct - \beta x) \\ \beta &= \frac{v}{c}, \quad \gamma = \frac{1}{\sqrt{1 - \beta^2}} \end{aligned}$$

(7.32)

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