Die Lorentz-Transformation

$$s_{12}^2 = c^2 t^2 - x^2 = c^2 t'^2 - x'^2$$

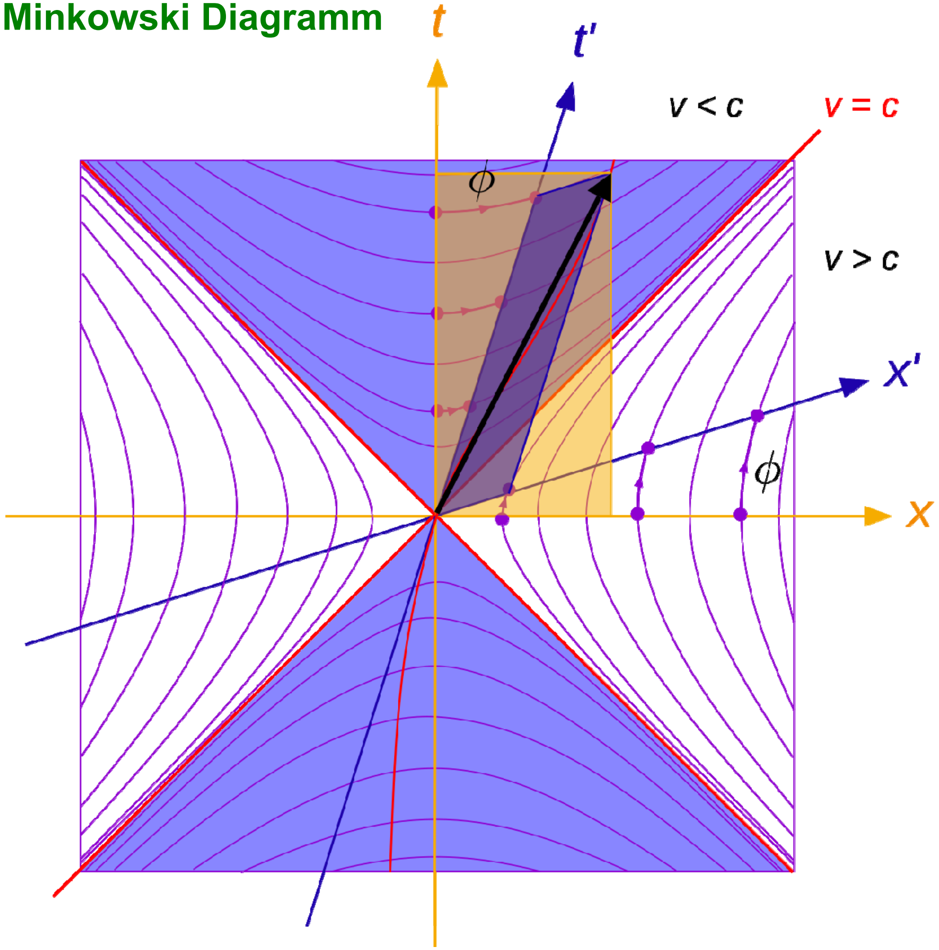
$$\gamma = \frac{1}{\sqrt{1 - v^2/c^2}}$$

$$\begin{pmatrix} c\,t' \\ x' \end{pmatrix} = \begin{pmatrix} \gamma & -\gamma\, v/c \\ -\gamma\, v/c & \gamma \end{pmatrix} \begin{pmatrix} c\,t \\ x \end{pmatrix}$$

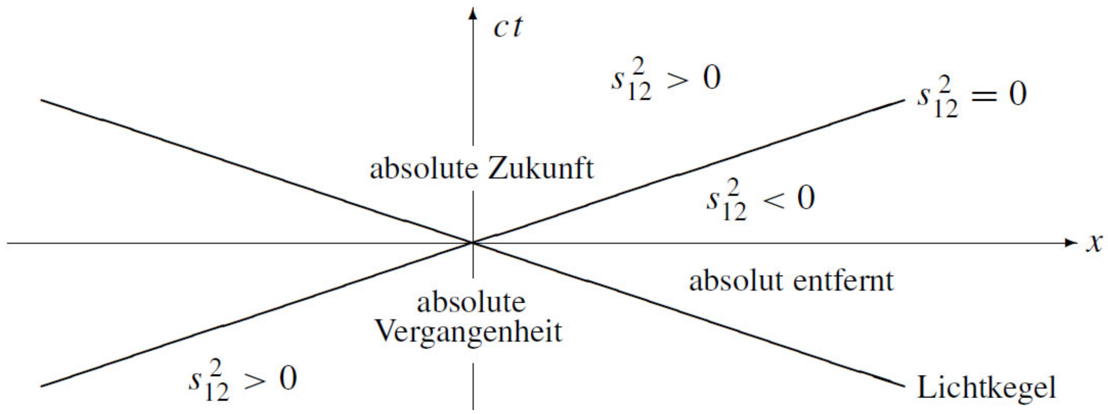
$$x' = \frac{x - v\,t}{\sqrt{1 - v^2/c^2}}\,, \quad y' = y\,, \quad z' = z\,, \quad c\,t' = \frac{c\,t - x\,v/c}{\sqrt{1 - v^2/c^2}}$$

Umkehrung

Minkowski Diagramm



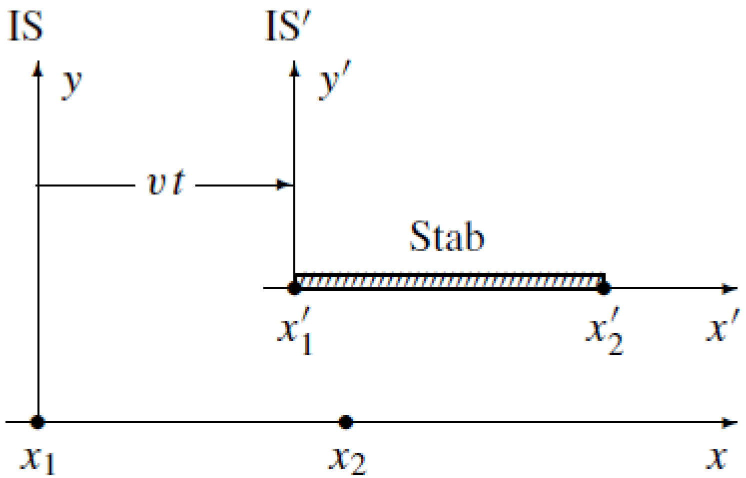
0.) Gleichzeitigkeit



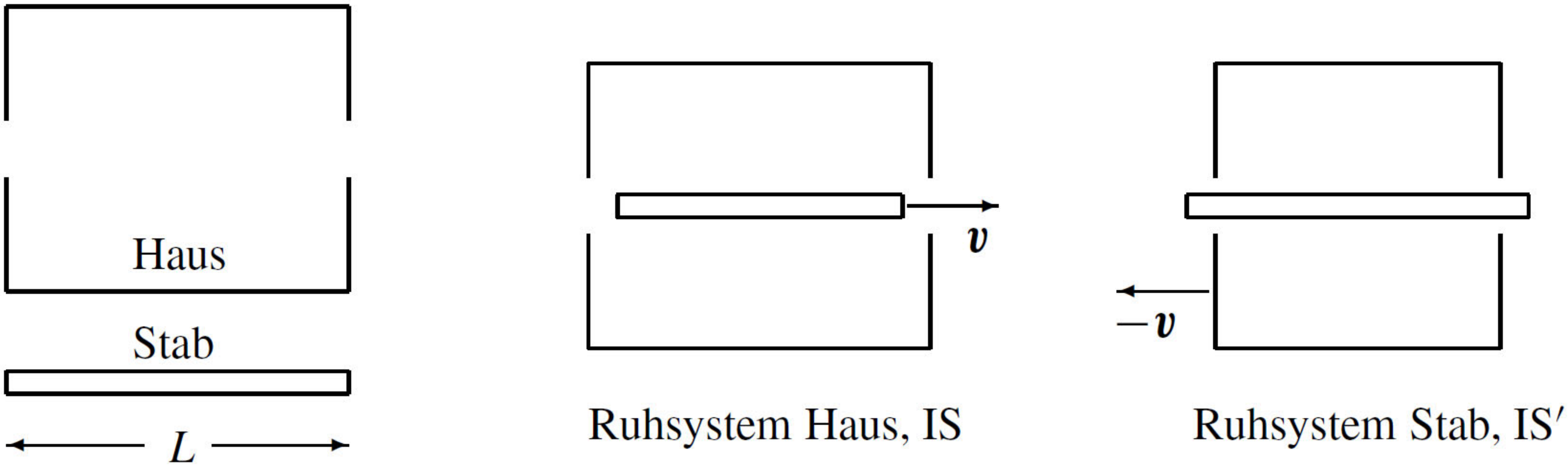
$$x' = \frac{x - vt}{\sqrt{1 - v^2/c^2}}, \quad y' = y, \quad z' = z, \quad ct' = \frac{ct - xv/c}{\sqrt{1 - v^2/c^2}}$$

1.) Längenkontraktion:

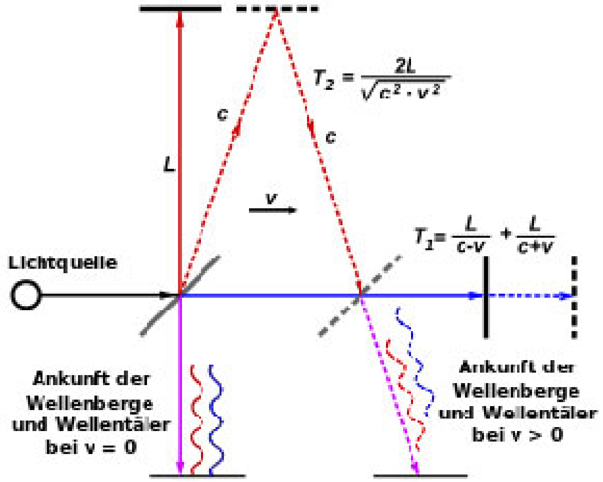
Messungen in einem System (hier: ein Stab) werden zu neuen Koordinaten transformiert, wenn das System sich bewegt.

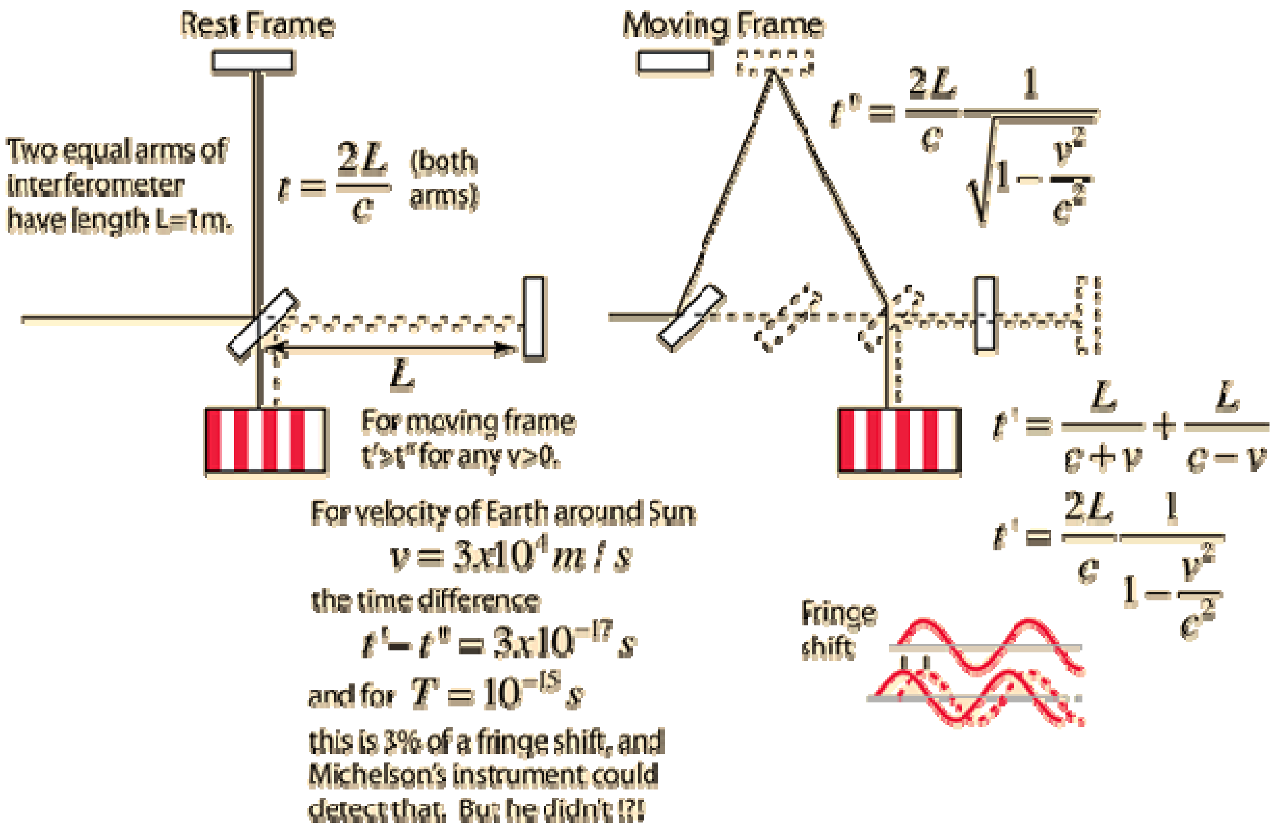


$$l = l_0 \sqrt{1 - \frac{v^2}{c^2}}$$



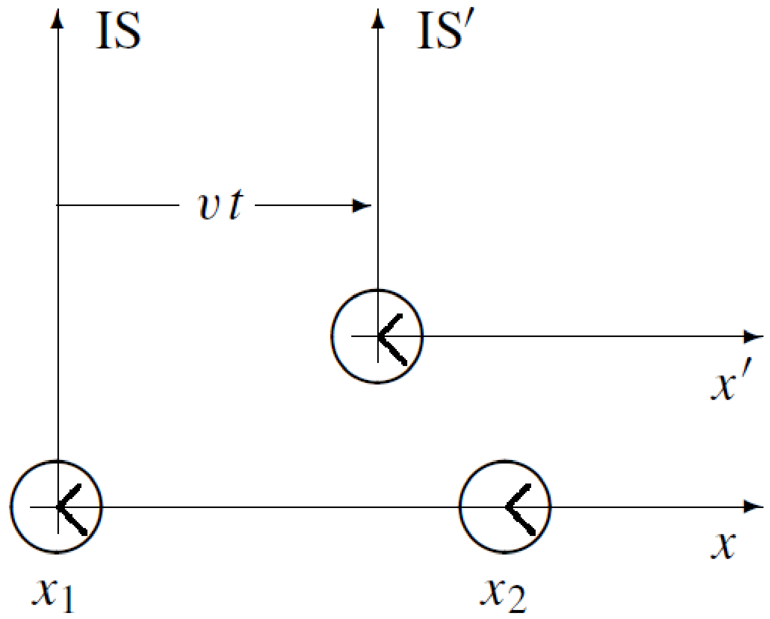
Anwendung der Längenkontraktion auf Michelson-Morley-Experiment





2.) Zeitdilatation einer bewegten Uhr

$$x' = \frac{x - vt}{\sqrt{1 - v^2/c^2}}\,, \quad y' = y\,, \quad z' = z\,, \quad c\,t' = \frac{c\,t - x\,v/c}{\sqrt{1 - v^2/c^2}}$$



$$t = \frac{t_0}{\sqrt{1 - v^2/c^2}}$$

Eigenzeit

Im eigenen Intertialsystem tickt die Uhr schneller als in allen anderen bewegten Systemen.

Die Eigenzeit ist in allen Inertitalsystemen gleich:

$$\tau = \int_{t_1}^{t_2} dt \sqrt{1 - \frac{v(t)^2}{c^2}}$$