Axioms A1. The speed of any light beam, measured in S or S', is 1.

A2. $T_v : \mathbb{R}^4 \Rightarrow \mathbb{R}^4$ is an isomorphism.

A3. If $T_v \begin{pmatrix} x \\ y \\ z \\ t \end{pmatrix} = \begin{pmatrix} x' \\ y' \\ z' \\ t' \end{pmatrix}$, then $y' = y$ and $z' = z$.

A4. If $T_v \begin{pmatrix} x \\ y_1 \\ z_1 \\ t \end{pmatrix} = \begin{pmatrix} x' \\ y' \\ z' \\ t' \end{pmatrix}$ & $T_v \begin{pmatrix} x \\ y_2 \\ z_2 \\ t \end{pmatrix} = \begin{pmatrix} x'' \\ y'' \\ z'' \\ t'' \end{pmatrix}$, then $x'' = x'$ and $t'' = t'$.

A5. The origin of S' moves in the positive direction of the x-axis of S at the constant velocity $v > 0$ as measured from S.

Thm Lorenz If α is the standard basis of $\mathbb{R}^4$, then $[T_v]_\alpha^\alpha = \begin{pmatrix} \frac{1}{\sqrt{1-v^2}} & 0 & 0 & \frac{-v}{\sqrt{1-v^2}} \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ \frac{-v}{\sqrt{1-v^2}} & 0 & 0 & \frac{1}{\sqrt{1-v^2}} \end{pmatrix}$

Notation For any linear operator T on V over F and any scalar $a \in F$, let $t_a \overset{def}{=} T - a \cdot I_V$

Def Let $T \in \mathbb{L}(V)$ for vector space V over F. For any $a \in F$, define $E_T(a) = N(T_a)$

Def 純量重數 The *multiplicity* of a scalar a w.r.t. $T \in \mathbb{L}(V)$ is the largest integer m with $(t-a)^m | f_T(t)$

Def 推廣特徵組 Let $T \in \mathbb{L}(V)$ for V over F. (λ, x) with $\lambda \in F$ and $x \in V \setminus \{0_V\}$ is a *generalized eigenpair* of T if $T_\lambda^l(x) = 0_V$ holds for some positive integer l.

Obs 暖身觀察 If (λ, x) is a generalized eigenpair of T, then λ is an eigenvalue of T.

Def $E_T(a) \to G_T(a)$ Let $T \in \mathbb{L}(V)$ for V over F. For any $a \in F$, let $G_T(a) = \{x \in V | T_a^l(x) = 0_V$ holds for a positive integer $l\}$