\[ g^T = g \implies L^T g L = g \]

\[ \det L^T = \det L \implies (\det L)^2 = 1 \]

\[ \implies \det L = \pm 1 \]

Proper Lorentz transformations are continuously connected to the identity.

Improper Lorentz transformations are not.

\[ \det A = -1 \implies \text{improper} \]

\[ \det A = 1 \implies \text{proper} \]

Reverse is not true, e.g., \( A = -1 \) then \( \det A = 1 \) but \( A \) is improper.

Lorentz group

\[ L^T g L = g \] set of matrices that satisfy this relation is called the Lorentz group

\[ g^T = g \] this relation constitutes 10 independent equations

\[ L \] has 16 parameters, therefore only 6 are independent.