We write the generators of the rotation group as J_i. They satisfy the commutation relations

$$[J_i, J_j] = i\epsilon_{ijk} J_k. \tag{1}$$

The smallest matricces satisfying these three commutation relations are

$$J_i = \frac{1}{2}\sigma_i, \tag{2}$$

where σ_i are the Pauli spin matrices. The Pauil matrices are Hermitian and thus the eommutation relations of Eq.(1) are invrariant under Hermitian conjugation.

Let us introduce another set of matrices defined as

$$K_i = \frac{i}{2}\sigma_i. \tag{3}$$

These three matrices are anti-Hermtian, and stasfy the commutation relations

$$[K_i, K_j] = -i\epsilon_{ijk} J_k, \qquad [J_i, K_j] = -i\epsilon_{ijk} K_k, \tag{4}$$

The three sets of the commuation relations given Eq.(1) and Eq.(4) are like those of the Lorentz group generated by three rotation and three boost generators. K_i genetate the Lorentz boost along the i^{th} axis.

These commutation relations are not invariant under the sign change in the rotation generators, but they are invariant undet the sign change in the K_i matrices. Thus, one set of generators can accommodate two boost operations in the two oposite directions. Thus, in the four-by-four representation, we can write the boost generators as

$$K_{44i} = \begin{pmatrix} K_i & 0 \\ 0 & -K_i \end{pmatrix}, \tag{5}$$

and

$$J_{44i} = \begin{pmatrix} J_i & 0 \\ 0 & J_i \end{pmatrix} \tag{6}$$

These four-by-four matrices satisfy the commutations relations of Eq.(1) and Eq.(4).

Indeed, the Dirac matrices in the Weyl representation are consistent with this form of the generators of the Lorents group.