Ch. 7: Enumerated and constructed vector spaces of all irreps of SU(2): |jm>

All found in products of j=1/2 irrep.

Ch. 8: explicit form for representation matrices in all irreps:

Eq. 7.3-16

$$D^j(\alpha,\beta,\gamma) = e^{-i\alpha m'} d^j(\beta)^{m'}_{m} e^{-i\gamma m}$$

plus Eq. 8.1-25

$$d^j(\beta)^{m}_{m'} = \text{ explicit mess}$$

Ch. 7, Eq. 7.5.14, partial wave decomposition:

$$\langle \vec{p}_f | T | \vec{p}_i \rangle = \sum \frac{2l+1}{4\pi} T_l(E) P_l(\cos\theta)$$

Wigner-Eckart Theorem

Haar measure for SU(2).

Helicity states and Jacob -Wick

Single particle

$$|\vec{p}\lambda\rangle$$

Two particle

$$|\vec{p}\lambda_1\lambda_2\rangle$$

Scattering

$$\langle \vec{p}_f \lambda_c \lambda_d | T | \vec{p}_i \lambda_a \lambda_b \rangle = \sum_J \langle \lambda_c \lambda_d \| T_J(E) \| \lambda_a \lambda_b \rangle d^J(\theta)^{\lambda_a - \lambda_b}_{\lambda_c - \lambda_d} e^{i(\lambda_a - \lambda_b)\phi}$$

E_3

Algebra:

$$\left[P_i, P_j\right] = 0$$

$$\left[J_i, J_j\right] = i\varepsilon_{ijk} J_k$$

$$\left[P_i, J_j\right] = i\varepsilon_{ijk} P_k$$

Casmirs: P^2 J·P

Induced representation:

- Abelian invariant subgroup: translations
- Factor group: rotations
- Diagonalize P's
- Select standard vector
- Little group is stability subgroup of standard vector in factor group:
  - rotations about standard vector, SO(2)
- Fill out irrep with action of factor group

$$|p,\theta,\phi,\lambda\rangle = R(\phi,\theta,0)|p,0,0,\lambda\rangle$$

$$P^2|p,\theta,\phi,\lambda\rangle = p^2|p,\theta,\phi,\lambda\rangle$$

$$J \cdot P|p,\theta,\phi,\lambda\rangle = \lambda p|p,\theta,\phi,\lambda\rangle$$

$$T(\vec{b})|p,\theta,\phi,\lambda\rangle = e^{-i\vec{b}\cdot\vec{p}}|p,\theta,\phi,\lambda\rangle$$

$$R|p,\theta,\phi,\lambda\rangle = e^{-i\lambda\psi}|p,\theta',\phi',\lambda\rangle$$