3.1) **Realistic Shell-Model Calculations**

\[ H = \sum \epsilon_n a_n^+ a_n + \sum W_{\beta\gamma} \, a_\beta^+ a_\gamma \]

- Construct basis states from the single particle states, and include only states up to a given shell.

- Calculate the two-body matrix elements for these states.

- Diagonalize the Hamiltonian.

**Comments:**

- The two-body matrix elements can be derived from the nuclear potential; can be simplified by considering closed shells or inert.

- Sometimes the single particle energies and the two-body matrix elements are fitted to experiment allowing to calculate all other states.