ABSTRACT

This thesis deals with applications of the spectral distribution methods to nuclear spectroscopic studies. Few properties like the ground state energy, ground state occupancy and other sum-rules related to single nucleon transfer reactions are dealt with.

The spectral distribution methods (SDM) offer a simple manner of studying these properties by expressing them in terms of moments defined on energy distribution . A new derivation of the inverse energy-weighted sum-rules is given by applying the SDM to the Rayleigh - Schroedinger perturbation theory. The scalar space result is then extended to the configurations. The results are applied to obtain corrections to the ground state energy estimate when the effective interaction is approximated by few model hamiltonians obtained by taking linear combinations of various parts of the pairing and quadrupole operators.

It is already established that the expectation value of an arbitrary operator can be expressed as a polynomial expansion as a function of one and two variables. The same result is derived geometrically here, in the CLT limit.

A large portion of this work concentrates on sum-rule analysis for single nucleon transfer reactions. Proton and neutron occupancies, centroids and widths for particle removal as well as particle addition strengths have been calculated for a range of nuclei lying in the s-d, f-p and upper

f-p-g shells. Since we are dealing with large spectroscopic spaces, calculations are performed on spaces partitioned according to proton-neutron configurations. Comparison with experimental results is made wherever possible.