A B S T R A C T

We have studied various applications of Spectral Distribution Methods.

This method deals with the distribution of quantities of interest in energy, configuration, isospin etc. These distributions are determined by a few low order system Hamiltonian moments. Moments are easy to calculate, because they are the traces of powers of the hamiltonian matrix. Moreover, by virtue of Central Limit theorem, only a few low order moments are needed to determine the state density. We have sought a proper representation of the state density in terms of these moments. Knowing the state density, the corresponding discrete eigenvalues are obtained by (1) modification of Ratcliffe's procedure, (ii) moment fitting method and (iii) using Cornish Fisher expansion.

The concept of single particle spherical orbits in which the individual nucleons move, provides an important clue about the structure of the nuclei. The spherical orbit occupancies in the ground states of nuclei are particularly interesting because they can be easily measured experimentally. We have performed numerical calculations to evaluate ground state occupancies in the f-p-g shell nuclei.

Another important clue about nuclear structure is provided by the expectation values of various operators. These expectation values can then be used to calculate various sum rule quantities.

We have rederived Halemane's expressions for inverse energy weighted sum rules by a different approach and studied their extension to Central Limit Theorem limit. Finally, we have used these rules to obtain corrections to estimates of ground state energy when an effective interaction is approximated by a linear combination of well known operators.