Abstract

The present work contains two parts: The first one is devoted to the investigation of mixed-symmetry structure in (A= 110, 130, 180) mass region and the second one to find the E0 transitions in these nuclei.

Collective excitations are the common phenomenon in atomic nuclei. A special class of collective excitations, called mixed-symmetry states, which are defined in the Interacting Boson Model-2 only and have been found in atomic nuclei and are interpreted geometrically as an out of phase motion of protons and neutrons. A number of one-quadrupole phonon mixed symmetry ($2^+_{1,ms}$) states have been found in vibrational like nuclei in A = 110, 130. 180 mass region. The energy of these states were fitted by performing an Interacting Boson Model-2 calculation, which shows that the evolution in energy can be modeled with an appropriate set of parameters in the IBM-2 Hamiltonian.

The isotopes that have been studied are divided into three regions: the first set in the A=110 isobars region (Mo, Ru, Pd and Cd) were selected on the basis that, these isobars are lie in the transition region between nuclei with (γ-soft), O(6) limit and spherical shape U(5) limit, as been determined the lowest mixed symmetry state and calculate the reduced transition probability B(E2) and B(M1), as well as to E0 transitions.

The second set; is bounded in between A=130-138 mass number isotopes of $^{130-138}$Ce. These nuclei are lie in the transition region between nuclei with (γ-soft), O(6) limit and spherical shape U(5) limit this is shows through approaching the neutrons from the closed-shell, also identify the mixed symmetry state and the reduced possibility transition, E0 transitions. The confirmation of this suggestion has been done by the calculation of the M1 strengths, $\delta(E2/M1)$ mixing ratio and $X(E0/E2)$ values.

The third set; is region have the mass number between A=180-186, represented $^{180-186}W$ isotopes. It is generally within the rotational deformed limit, have been identified mixed symmetry state and the reduced possibility transition and the study of the electric monopole transitions and calculate the mixing ratio X(E0/E2) and δ(E2/M1). The influence of model parameters and F-spin mixing on the energy of 2_3^+ and 2_4^+ states suggested that these states are mixed-symmetry states ($F = F_{max}$-1) in these isotopes. The confirmation of this suggestion has been done by the calculation of the M1 strengths, $\delta(E2/M1)$ mixing ratio and $X(E0/E2)$ values.

All the calculated results were compared with the available experimental data and get reasonable agreement.