The study of positive and negative parity states in ^{184}Os nucleus

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The nuclear structure of the nuclei contains protons and neutrons in the nucleus with different combination. The nuclear structure consist of various bands as ground state band, $K^{\pi}=0^{+}$ beta band and $K^{\pi}=2^{+}$ gamma band as well as non - bands region. These band levels have positive parity as well as negative parity [1].

The energy spectra of positive and negative parity states, of various isotopes studied by various author with different method as discussed previously e.g. in [2]. The energy spectra also studied by Interacting boson model -1 (IBM-1) [3] used for the theoretically calculation of positive and negative parity states in the [4].

Here the different parameters sets are used for positive and negative parity states as well. In the interacting boson model sd-IBM, s (l=0) boson, d (l=2) boson used for the calculation of positive parity states in the most of medium and heavy nuclei. The negative parity states are not described by s and d bosons. For the negative parity states, the f (l=3) boson used for the calculation for the nuclei corresponds to octopole ($L^{\pi} = 3^{-}$) vibrations around spherical or quadrupoly deformed ground state shape. The octopole vibrations observed between most of the nuclei of the nuclear chart. The systematics of excitation energies of lowest 2^{+} and 3^{-} states is shown in [5] and the drop in the 3^{-} states and almost uniformity remains in the lowest 2^{+} states. This drop related with 1 particle- 1 hole (1p-1h) excitations between two single particle orbitals differing by 3 times of orbital angular momentum ($\Delta l = 3$ pairs). This $\Delta l = 3$ pairs exist in all medium and heavy nuclei is related with collective octopole state and octopole vibration observed. The enegry states observed by modifying Hamiltonian of sd – IBM.

Then Hamiltonian for the positive and negative parity states of the type is

$$H = H_{SD} + H_{f} + V_{SDF} \qquad (1)$$

Here we use the MULT form of Hamiltonian and program to solve for the energy spectra, which is given in the ref. [6]. Here we study the energy spectrum of ^{184}Os. For positive parity states, we use the parameter from [7], which recently discussed. This work further extention in negative parity states of the ^{184}Os nucleus. The experimental data for analysis is taken from NNDC website

[8] and compared with the theoretical energy calculated by various trial and for negative parity states we find from the trial running of the program given in [6] using the parameters (in KeV) ε_f =1490, (A_0=70 for even spin and 160 for odd spin), A_2 = -18.5 and A_3 = 860 respectively.

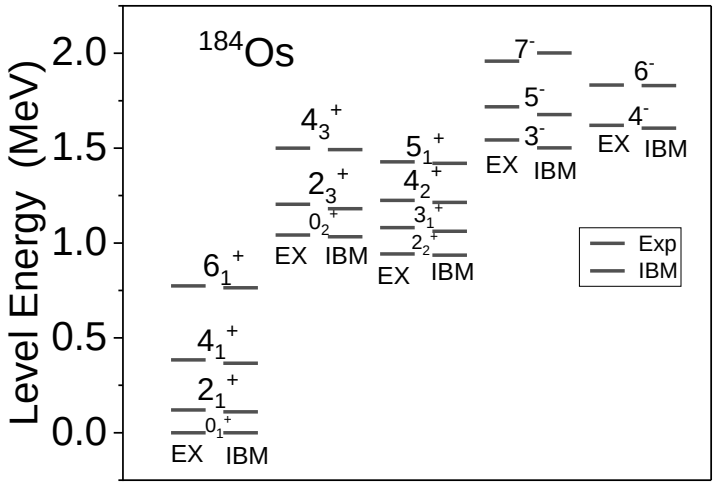

Fig.1. Partial energy spectrum of ^{184}Os with positive and negative parity states for experimental energies and theoretical calculated energies using IBM. .

Result: The theoretical calculated energies (IBM) using Interacting Boson Model-1 (IBM-1) using the program PHINT [6] and compared with experimental energies (EX) from NNDC [8] in MeV. For enegry less then 2 MeV, the energy spectrum of EX and IBM is reproduced well.

References:

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