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$\delta(E2/M1)$ and $X(E0/E2)$ mixing ratios in ^{134}Ba by means of IBM-2

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Abstract

The ^{134}Ba isotope ($Z = 56$) lies in the transitional region closer to the vibrational range of nuclei. Energy levels B(E2), B(M1) and the mixing ratios $\delta(E2/M1)$ and $X(E0/E2)$ for selected transitions were calculated in the framework of the proton-neutron interacting boson model (IBM-2). All results were compared with experimental data. Some experimental $X(E0/E2)$ ratios were calculated from available experimental data. Majorana parameters were found to have a great effect on the calculated energy levels of the 2_3^+ and 2_4^+, which indicate that both of them have mixed symmetry properties.

Key Words: Energy levels, transition probability, mixing ratios, interacting boson model

1. Introduction

The ^{134}Ba nucleus belongs to a transitional region of $A \approx 130$ whose characteristics have been explored with alternative models [1–3]. ^{134}Ba has been introduced as a possible candidate for critical symmetry E(5) of transition between vibrational U(5) nuclei and γ-unstable O(6) nuclei, by Casten et al. [4] and Da-Li et al. [5]. Recently, there has been an attempt to explore the structure of this isotope as a part of general study of nuclei near Z=52–62 [6]. Kumar et al. [7] investigated the level structure of $^{122-134}$ Ba isotopes, in the framework of IBM-1 and they concluded that the energy of 2_1^+ is increased in faster rate compared with the energy of 2_2^+ at $N = 72$ to 78.

The calculations of Gerceklioğlu [8] on transfer strength of the excited 0^+ states in ^{130,132,134}Ba isotopes, found that most of collective states are located at 2.159 MeV in the experimental data and at 1.71 MeV in model predictions. He used the Hamiltonian which includes monopole paring, quadrupole-quadrupole and spin-quadrupole interactions, to produced three 0^+ states in ^{134}Ba and gives a reasonable explanation for abundance of the 0^+ excitation in the low transfer strength of 0^+ states.