PROJECTED SHELL MODEL STUDY OF YRAST BANDS IN EVEN-EVEN $^{90-100}$Ru ISOTOPES

*Arvind Bhat, Arun Bharti,Ramesh Bhat,Preeti Verma and S.K. Khosa
Department of Physics and Electronics,
University of Jammu, Jammu-180006, INDIA
**Email:bhatarvind.muran@gmail.com*

Introduction

The ground state properties of even- even Ru isotopes have been the subject of number of experimental studies. Much of the nuclear structure information has been obtained through in beam gamma ray spectroscopic experiments with heavy ions and coulomb excitation techniques.

Alongside large scale effort that has been made on the experimental side, an equally matching effort has been put in on the study of even-even Ruthenium isotopes by developing theoretical models to explain the character of yrast spectra in these nuclei.

Recently, the Projected Shell Model (PSM) has become quite popular to study the structure of deformed nuclei [1]. The advantage in this method is that the numerical requirements are minimal and therefore, it is possible to perform a systematic study for a group of nuclei in a reasonable time frame. A systematic study of the neutron-rich nuclei in the mass region A=100 and rare-earth nuclei using PSM has been carried out sometime back and the agreement between PSM results and experimental data has been found to be quite good [2,3].

The Hamiltonian which has been used throughout the present work is described as follows.

$$\hat{H} = H_0 - \frac{1}{2}\chi\sum_{\mu}\hat{Q}^{\dagger}_{\mu}\hat{Q}_{\mu} - G_M\hat{P}^{\dagger}\hat{P} - G_Q\sum_{\mu}\hat{P}^{\dagger}_{\mu}\hat{P}_{\mu}$$

where H_0 is the spherical single particle Hamiltonian. The second term is the quadrupole-quadrupole interaction and the last two terms are the monopole and quadrupole pairing interactions, respectively. The strength of the quadrupole-quadrupole term is obtained via self-consistent conditions with a given deformation parameter ϵ_2.

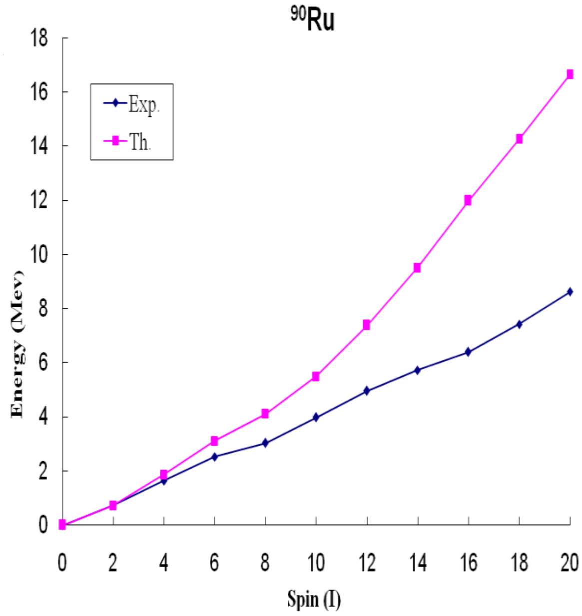
A microscopic description of yrast states, back-bending phenomena, B(E2) transition probabilities and g-factors has been carried out in Ru isotopes with A= 90-100 studied in the framework of PSM, by employing quadrupole plus monopole and quadrupole pairing force in the Hamiltonian. The prolate structure of the bands has been investigated. The calculations reproduce the observed yrast spectra, B(E2) transition probability, back-bending phenomena and g-factors with reasonable accuracy. The observed deformation systematics in $^{90-100}$Ru isotopes depends on the increase of occupation probability of $(1h_{11/2})_{\nu}$ orbit. From the results presented it may be noted that for the set of $^{90-100}$Ru isotopes the calculated yrast spectra is in satisfactory agreement with experimental yrast spectra only for low lying states up to spin 6^{+}. The results on band diagram show that the yrast spectra in Ru isotopes do not arise from a single intrinsic state i.e. they arise from one, more than one intrinsic state.

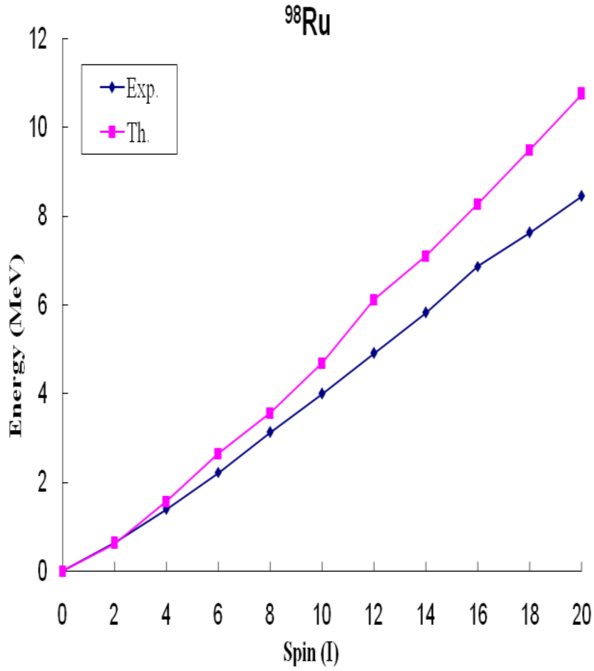
References:

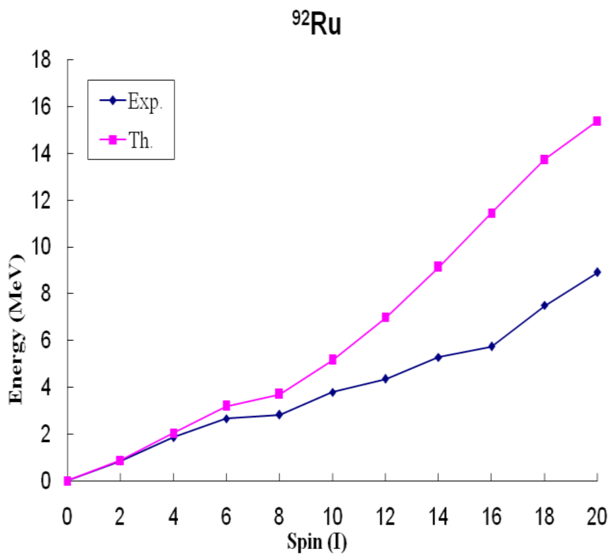
[1] K. Hara and Y. Sun, Int. J. Mod. Phys. **E4**, 637 (1995).

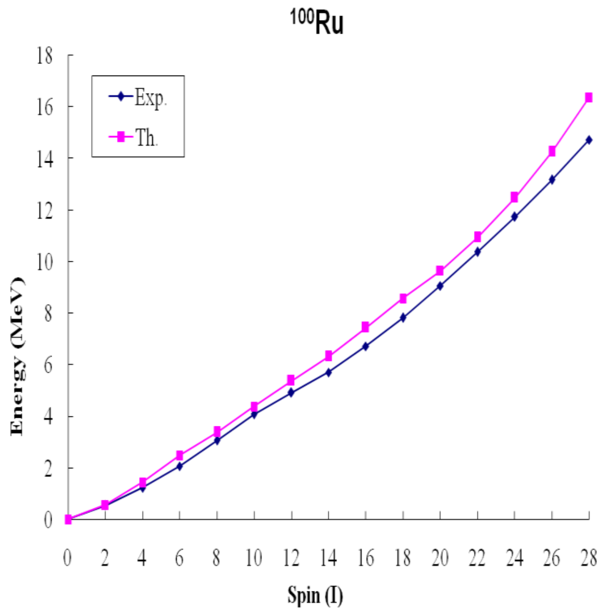
[2] Sonia Verma, Parvaiz Ahmad Dar, and Rani Devi, Phys. Rev. C **77,** 024308 (2008).

[3] B.D.Sehgal, Rani Devi and S.K.Khosa, *J.Phys.G: Nucl.Phys.* **32,** 1211 (2006).









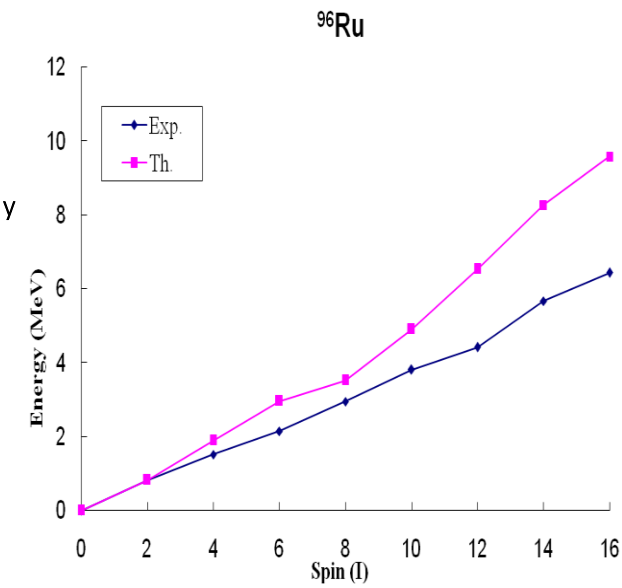


Figure1. Comparison of the Calculated spectra with the experimental data for $^{90-100}$Ru isotopes.