SHELL MODEL STUDY OF SHAPE CHANGE ON N=Z LINE WITH VAP-GCM ANALYSIS BASED ON HFB

Takahiro Mizusaki, Institute for Natural Sciences, Senshu University, Tokyo, Japan

Kazunari Kaneko[1], Noritaka Shimizu[2]

1 Department of Physics, Kyushu Sangyo University, Fukuoka, Japan
2 Center for Nuclear Study, University of Tokyo, Hongo, Tokyo, Japan

The spectra of *N~Z* nuclei around mass 70 show oblate-prolate shape coexistence for the ground states. For high spin states, backbending phenomena have been measured [1] due to the excitation from *fp* orbits to *g9/2* or higher orbits. Various shape change are expected for the ground states and high spin states of these nuclei on the *N=Z* line. Theoretically the Projected Shell Model (PSM) [2], which is well suited for the study of high spin states, has succeeded in describing the backbending phenomena on the *N=Z* line.

These two decades, large-scale shell-model calculations have been rapidly applied to wider shell model spaces [3,4], i.e., full *fp* and *fpg* shell. Moreover, realistic residual interactions for shell model calculations have also been extensively studied, i.e., KB3 [5], GXPF1[6], JUN45[7], PMMU[8] and so on. Based on these recent developments, we study such shape changes of *N=Z* line from low-spin to high-spin states in the framework of the shell model. To describe them, we take *p3/2*, *f5/2*, *p1/2*, *g9/2* and *d5/2* orbits as the shell model space, which is too huge for conventional Lanczos shell model diagonalization. Here we use the Hartree-Fock Bogoliubov (HFB) based projected methods.

In this presentation, we focus on the structures of ^{68}Se, which is one of the *N=Z* nuclei. We use the angular momentum projected HFB methods with the PMMU interaction. One method is the Generator Coordinate Method (GCM) with angular momentum projected HFB states, being generated by a restriction on the β-γ plane. Other is a Variation-After-Projection (VAP) method based on the HFB. The former is easy to read the physics, but the latter gives better energies than the previous method. Based on the HFB, we can appropriately handle pairing correlation.

With these methods, we can reproduce low-spin spectra for ^{68}Se with PMMU shell-model interaction and also reproduce the backbending phenomena better than the one of the JUN45 shell model interaction. We will discuss a mechanism of backbending phenomena in a view of shell model calculations.

This research was supported in part by the Senshu University research grant at 2014, “Study of shape coexistences by the quantum-number projected GCM calculations”.

REFERENCES

[1] For example, S.M. Fischer, et. al., Phys. Rev. Lett. **84** (2000) 4064, Phys. Rev. Lett. **87** (2001) 132501
[2] Yang Sun, Eur. Phys. J**420** (2004) 133-138.
[3] E. Caurier, et al., Rev. Mod. Phys. **77**, 427-488 (2005).
[4] N. Shimizu, et. al., Prog. Theor. Exp. Phys. (2012) 01A205.
[5] A. Poves. and A.P. Zuker, Phys. Rep. **70**, 235 (1981).
[6] M. Honma, T. Otsuka, B.A. Brown and T. Mizusaki, Phys. Rev. C**65**, 061301(R) (2002), Phys. Rev. C**69**, 034335 (2004).
[7] M. Honma, T. Otsuka, T.Mizusaki, and M. Hjorth-Jensen, Phys.Rev. C**80**, 064323 (2009).
[8] K. Kaneko et. al. to be submitted.