

E438

PROPOSAL FOR EXPERIMENT AT RCNP

12 February 2014

TITLE:**Study of superdeformed structure in $A \sim 40$ nuclei****SPOKESPERSON:**

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EXPERIMENTAL GROUP:

Full Name	Institution	Title or Position
Nori Aoi	RCNP, Osaka University	Professor
Hooi Jin Ong	RCNP, Osaka University	Lecturer
Takashi Hashimoto	RCNP, Osaka University	Assistant Professor
Tetsuya Yamamoto	RCNP, Osaka University	D1
Mana Tanaka	RCNP, Osaka University	M1
Hiroataka Suzuki	RCNP, Osaka University	M1
Gaku Isago	RCNP, Osaka University	M1
Susumu Shimoura	CNS, University of Tokyo	Professor
Shin'ichiro Michimasa	CNS, University of Tokyo	Assistant Professor
Shinsuke Ota	CNS, University of Tokyo	Assistant Professor
Shintaro Go	CNS, University of Tokyo	D3
Keiichi Kisamori	CNS, University of Tokyo	D2
Motonobu Takaki	CNS, University of Tokyo	D2
Rin Yokoyama	CNS, University of Tokyo	D1
Motoki Kobayashi	CNS, University of Tokyo	M2
Kazuma Kobayashi	Rikkyo University	M1
Atsuko Odahara	Department of Physics, Osaka University	Associate Professor
Ayumi Yagi	Department of Physics, Osaka University	M2
Tomoki Ishigaki	Department of Physics, Osaka University	M1
Shinnosuke Yoshida	Department of Physics, Osaka University	B4
Michael Carpenter	Argonne National Laboratory	Staff Physicist
Paul Fallon	Lawrence Berkeley National Laboratory	Staff Physicist
Takeshi Koike	Tohoku University	Associate Professor

and CAGRA collaboration

RUNNING TIME:

Beam tuning and DAQ setup	0.5 days
Data runs	7.5 days
Total	8 days

BEAM LINE:

AVF : EN course

BEAM REQUIREMENTS:

Type of particle	^{24}Mg
Beam energy	96 MeV
Beam intensity	≤ 10 pA

BUDGET:

Contents	amount
Target chamber, Si detector frame, beam pipe	500 kYen
Enriched ^{24}Mg foil ($0.5 \text{ mg/cm}^2 \times 2$), target frame	200 kYen
Travel expense of collaborators (Tokyo, Tohoku)	300 kYen
Total	1,000 kYen

TITLE:**Study of superdeformed structure in A~40 nuclei****SPOKESPERSON:** Eiji Ideguchi**SUMMARY OF THE PROPOSAL**

We would like to study superdeformed (SD) structures of ^{44}Ti and ^{45}Sc nuclei in A~40 region. Unique feature of this A~40 region is that the SD shell structure remarkably appears comparing to the case in heavier mass region. Such situation will also hold in more deformed region where the onset of hyperdeformation is expected. Therefore, it will be important to examine how deformed shell structure appears in this region in order to further investigate the limit of nuclear deformation.

Among these A~40 SD nuclei, high-spin level structure in ^{44}Ti was previously studied by C.D. O'Leary *et al.* [5] and the excited band built on the 0_2^+ level is supposed to be a SD band with 8p-4h configuration. However, its transition quadrupole moment has not been measured. Therefore, we plan to perform a life-time measurement of the band to firmly identify its SD structure. A Clover Ge detector array, CAGRA (Clover Array Gamma-ray spectrometer at RCNP/RIBF for Advanced research) in conjunction with a Si-Ball, a 4π Si ΔE detector array will be utilized for the in-beam γ -ray spectroscopy using a $^{24}\text{Mg}+^{24}\text{Mg}$ reaction.

In addition to the study of ^{44}Ti , we also plan to investigate predicted SD band in ^{45}Sc which can be produced simultaneously in the $^{24}\text{Mg}(^{24}\text{Mg}, 3p)$ reaction.

Another unique feature of SD nuclei is the onset of octupole collectivity. Since the SD shell structure appears by crossing of single particle orbitals of different parities at large deformation, octupole excitations built on the superdeformed band are expected, i.e. $[200]1/2 \rightarrow [321]5/2$ and $[321]3/2 \rightarrow [202]3/2$ in ^{44}Ti [6, 7]. We would like to investigate octupole excited levels built on the SD band of ^{44}Ti . By employing the γ -ray linear polarization sensitivity of CAGRA, multipolarity of γ -ray transitions can be identified and the octupole excited levels will be studied.