RCNP EXPERIMENT E277

PROPOSAL FOR EXPERIMENT AT RCNP

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TITLE:

Study of High-Spin Isomer in ^{151}Er using Ar Beam

SPOKESPERSON:

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EXPERIMENTAL GROUP:

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Takeshi Furukawa	Dep. of Physics, Osaka Univ.	D3
Yosuke Akasaka	Dep. of Physics, Osaka Univ.	M2
Akihiko Sato	Dep. of Physics, Osaka Univ.	M1

RUNNING TIME:	Installation time without beam	7 days(for each beam time)
	Test running time for experiment	1 day
	Data runs	5 days
BEAM LINE:		AVF : EN course
BEAM REQUIREMENTS:	Type of particle	^{40}Ar
	Beam energy	195 MeV (4.9 MeV/u)
	Beam intensity	8 pnA
BUDGET:	Experimental expenses	4,880,000 yen

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SUMMARY OF THE PROPOSAL

We propose the experiment to determine the spin-parity of high-spin isomer in ^{151}Er by using the γ-ray angular correlation and the γ-ray linear polarization. This experiment will be carried out at EN course by using the primary Ar beam which will be directly provided by the upgraded AVF cyclotron and ECR ion source.

High-spin isomers were systematically studied in $N = 83$ isotones. Life times of these isomers range between $\sim$10 ns and $\sim\mu$s. These isomers are of stretch coupled configurations and oblate shapes. They can be categorized to be high-spin shape isomers, as they are caused by the sudden shape change from near spherical to an oblate shape. Their spins and parities are $49/2^+$ and 27^+ for odd and odd-odd nuclei, respectively, in $N = 83$ isotones with $60 \leq Z \leq 66$.

However, spin-parity of the high-spin isomer in an $N = 83$ isotone ^{151}Er with $Z = 68$ was reported to be $67/2^-$ by Grenoble group. This spin-parity could not be reproduced by a deformed independent particle model, which explains well the isomerism of high-spin isomers in other $N = 83$ isotones. This model predicts that the spin-parity of the isomer would be $49/2^+$ or $61/2^+$. If the spin-parity of the high-spin isomer of ^{151}Er is really $67/2^-$, it requires to find a new mechanism to produce the isomer.

Grenoble group determined this spin-parity based on the results of γ-ray angular distributions and conversion electrons. However, they have some contradictions between both results for λ of transitions and some ambiguity of determination of E3 transitions directly deexciting the high-spin isomer.

In order to study the isomerism of ^{151}Er, we intend to determine the spin-parity of high-spin isomer by measuring the γ-ray linear polarizations as well as γ-ray angular correlations. These quantities depend also on the initial and final state spins of transitions.

High-spin states of ^{151}Er will be populated by the reaction of ^{116}Sn(^{40}Ar,5n). The energy of ^{40}Ar beam is requested to be 195 MeV with intensity of 8 pnA. In this case, the angular momentum brought into the ^{156}Er compound nucleus was estimated to be 69 $\hbar$. Gamma-rays will be detected by 4 high purity germanium detectors.

We request 1 day test run for the preparation of circuits and DAQ systems and 5 days data runs.