RCNP EXPERIMENT E265

PROPOSAL FOR EXPERIMENT AT RCNP

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TITLE:
Magnetic Moment of ^{36,37}P

SPOKESPERSON:

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EXPERIMENTAL GROUP:

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RUNNING TIME:	Installation time without beam	3 days
	Beam tuning and test running	2 days
	Data runs	4 days
		(Total Beam Time 6 days)
BEAM LINE:		Ring : EN course
BEAM REQUIREMENTS:	Type of particle	^{40}Ar
	Beam energy	70 MeV per nucleon
	Beam intensity	200 pnA
	Any other requirements	beam pulsing

BUDGET:	Installation of DC power supply and RF amplifier	200,000
	Catcher material (crystal etc.)	100,000
	Travel expense	100,000
	Total	500,000

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SUMMARY OF THE PROPOSAL

We propose an experiment on the magnetic moments of short lived β emitting nuclei ^{36,37}P, utilizing the powerful radioactive nuclear beam provided by the up-graded RCNP ring cyclotron and the fragment separator installed at EN course.

These nuclei has atomic number Z =15 and neutron number N = 19,20, i.e., they are near the shell gaps of the magic number 20 and the newly suggested magic number 16. From the experiment, we are able to discuss the configuration mixing information near the shell gaps. This information is important for understanding of the formation and vanishing of the shell gaps. Most of all, the spin and parity of the ground state of these nuclei is very important, but has not been determined yet. By measuring the g factors, we can determine the spins, compared with the theoretical pred! ictions.

In the proposed experiment, the polarized ^{36,37}P nuclei are produced in the heavy ion collisions and separated by a separator in EN course. After implanted in a single crystal Si, the magnetic moment, more exactly the g-factor, will be measured by means of the β-NMR technique. By comparing with the theoretical g-factors for several possibilities of the ground state spins, the experimental g-factors can determine the spins. The more detailed discussion can also be possible on the nuclear structure and the configuration mixing from the shell model calculations with the interaction between sd and f shells.

Although the qualitative understanding of the polarization mechanism is established, the actual degree of polarization to be obtained is not so clear. However, we can expect some of the polarization of around 3 %, and the abundant incident beam of ^{40}Ar can produce rather high rate of the β rays of about 250 c/s from the nuclei, which mak! es the present measurement possible in 4 days of net data taking time (6 days total including test run).