E436

RCNP EXPERIMENT E

PROPOSAL FOR EXPERIMENT AT RCNP

16 July 2014

TITLE: Probing High-Spin States in ^{61}Fe Using the ^{48}Ca(^{16}C,3n) Reaction

SPOKESPERSON:

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and CAGRA collaboration		

RUNNING TIME:	Installation time without beam	5 days
	Beam Tuning	1 days
	Data runs	7 days
BEAM LINE:		EN
BEAM REQUIREMENTS:	Type of particle:	^{18}O
	Reaction to be used:	^{9}Be(^{18}O,^{17}N)^{10}B
	Beam energy:	9.3 MeV/A
	Beam intensity:	up to 2pμA

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SUMMARY OF THE PROPOSAL

We propose to identify high-spin states in ^{61}Fe utilizing the radioactive-ion beam, ^{16}C, which is under development at RCNP. This nucleus have been studied up to moderate spins utilizing deep-inelastic collisions in conjunction with Gammasphere [1]. Interest in Cr-Ni nuclei around $N = 40$ has resulted from the evidence of collectivity at or near the ground state in the $N = 40$ isobars ^{64}Cr, ^{66}Fe and ^{68}Ni. A recent paper by Carpenter *et al.*, [3] has attempted to reproduce the yrast structures of ^{60,62,64,66,68}Fe and ^{60,62,64}Cr using a simple two-band mixing calculation where shapes of both spherical and deformed states are assumed to co-exist and interact resulting in the observed behavior of the level structure below I=10 $\hbar$. This analysis relies heavily on the availability of high-spin data measured for ^{58,60}Fe using fusion-evaporation reactions. In order to confirm the conclusion of ref. [3] that the observed collectivity at $N = 40$ results from deformation as opposed to vibration, we propose to begin a program to measure high-spin states in neutron-rich Fe nuclei using fusion evaporation reactions with radioactive beams. As a first case, we propose to populate high-spin states in ^{61}Fe using the ^{48}Ca(^{16}C,3n) reaction with the goal of extending in spin the states built on top of the known $9/2^+$ isomer and identifying the unfavored signature partner band associated with the underlying $g_{9/2}$ configuration. These observation will provide the necessary information to ascertain whether or not the $9/2^+$ state is prolate or oblate deformed. Determining the deformation driving effects of the $g_{9/2}$ neutron orbital as one approaches $N = 40$ in the Fe and Cr isotopes is critical if one is to understand fully the nature of the collectivity observed near $N = 40$ and below $Z = 28$. Excited states in ^{61}Fe will be identified by measuring the γ rays de-exciting populated levels with the CAGRA spectrometer.