RCNP EXPERIMENT E338

PROPOSAL FOR EXPERIMENT AT RCNP

September 16, 2009

TITLE:
Additional Measurements for E252: High Resolution Study of Isospin mixing in Fermi Excitation via ^{56}Fe(^{3}He,t) Reaction at 100MeV/nucleon

SPOKESPERSON:

Full Name	Hirohiko Fujita
Institution	Research Center for Nuclear Physics, Osaka University
Title or Position	Collaborative Researcher
Phone number	06 6879 8916
E-mail	hfujita@rcnp.osaka-u.ac.jp

EXPERIMENTAL GROUP:

Full Name	Institution	Title or Position
Y. Fujita	Osaka University	Associate Professor
G.P.A. Berg	University of Notre Dame, USA	Senior Researcher
T. Adachi	KVI, Netherlands	Researcher
R.W. Fearick	University of Cape Town, South Africa	Researcher
J. Carter	University of the Witwatersrand, South Africa	Professor
K. Hatanaka	RCNP, Osaka University	Professor
H.J. Ong	RCNP, Osaka University	Assistant Professor
R. Neveling	iThemba LABS, South Africa	Researcher
Y. Shimbara	Niigata University	Researcher
F.D. Smit	iThemba LABS, South Africa	Senior Researcher
G. Süsoi	Istanbul University	Master Student
T. Suzuki	RCNP, Osaka University	Researcher
A. Tamii	RCNP, Osaka University	Associate Professor
J. Thies	Muenster University	Ph.D. Student
M. Yosoi	RCNP, Osaka University	Associate Professor

RUNNING TIME: Beam tuning for the dispersion matching 1.5 day
+ Data taking time including calibration run 0.5 day

BEAM LINE: Ring : WS course

BEAM REQUIREMENTS:

Type of particle	^{3}He
Beam energy	300 MeV
Beam intensity	$\leq$ 20 nA
Other requirements	energy spread $\leq$ 100 keV halo-free, small emittance

BUDGET: No special budget is required.

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SPOKESPERSON: H. Fujita

SUMMARY OF THE PROPOSAL

As an additional study of E252, we propose a high resolution measurement of the ^{56}Fe(^{3}He,t)^{56}Co reaction at 100 MeV/nucleon. In the E252 beam time, the ^{56}Fe(^{3}He,t) reaction was measured at 140 MeV/nucleon using the Grand Raiden spectrometer to study isospin mixing between the isobaric analog state (IAS, mainly $T = 2$) and the neighboring 0^+ state (mainly $T = 1$). With a dispersively transported ^{3}He beam, an energy resolution of 19 keV (FWHM) was realized. Owing to the high resolution, three peaks were clearly separated from the IAS at 3.60 MeV. We tried to identify the $T = 1$ 0^+ state from their angular distributions, however, they have similar shapes for all these states and the IAS. Although J^π values of these states could not be determined, the $\Delta L = 0$ character was confirmed from the 0° dominated shapes of the angular distributions.

Since the strength of the Fermi and Gamow-Teller interactions are different at different energies, we propose to measure the same reaction at 0° at the lower energy of 100 MeV/nucleon. This will allow to distinguish the 0^+ and 1^+ transitions. At 100 MeV/nucleon it is expected that Fermi strength is about 40 % stronger compared to the strength measured previously at 140 MeV/nucleon. Although an even larger difference is expected at lower energy, we choose 100 MeV/nucleon in order to avoid multi-step reaction effects. We also plan to take data for the ^{54}Fe and ^{58}Ni targets for calibration purposes.

The Grand Raiden spectrometer and the standard VDC focal plane detector system will be used for the magnetic analysis and the detection of the outgoing tritons. This experiment requires a good quality single-turn extracted 100 MeV/nucleon ^{3}He beam of up to 40 nA. Complete matching conditions and over-focus mode will be applied to realize an energy resolution comparable to the 19 keV obtained in E252.