

E365

PROPOSAL FOR EXPERIMENT AT RCNP

7 February, 2011

TITLE: Systematic studies of neutron-proton pairing in *sd*-shell nuclei using (p, ^3He) and (^3He , p) transfer reactions

SPOKESPERSON:

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EXPERIMENTAL GROUP:

Full Name (* theorist)	Institution	Position
N. Aoi	RIKEN, Nishina Center	Staff Researcher
A. O. Macchiavelli	Lawrence Berkeley National Laboratory	Staff Researcher
P. Fallon	Lawrence Berkeley National Laboratory	Staff Researcher
D. Beaumel	IPN Orsay	Staff Researcher
I. J. Thompson*	Lawrence Livermore National Laboratory	Professor
A. Tamii	RCNP, Osaka University	Associate Professor
K. Hatanaka	RCNP, Osaka University	Professor
Y. Fujita	RCNP, Osaka University	Associate Professor
H. J. Ong	RCNP, Osaka University	Assistant Professor
T. Suzuki	RCNP, Osaka University	Assistant Professor
Y. Yasuda	RCNP, Osaka University	Postdoctoral researcher
J. Zenihiro	RCNP, Osaka University	Postdoctoral researcher
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H. Matsubara	CNS, Univ. of Tokyo	Postdoctoral researcher
T. Kawabata	Dep. of Physics, Kyoto University	Associate Professor
N. Yokota	Dep. of Physics, Kyoto University	M1
E. Ganioglu	Science Faculty, Istanbul University	Assistant Professor
G. Susoy	Science Faculty, Istanbul University	D1

RUNNING TIME: Installation time without beam: 3 days (for each beam time)

Development of device: 1 day

Test running time for experiment: 2 days

Data runs: 152 hrs

BEAM LINE: Ring: WS course

BEAM REQUIREMENTS: Beam 1: proton at 50 MeV, 50 pA -- 81 hrs

Beam 2: ^3He at 25 MeV, 50 pA -- 71 hrs

BUDGET: 1. Targets (^{24}Mg , ^{28}Si , ^{32}S , ^{40}Ca) 200 k yen *4

2. a) Plastic scintillator for particle detection with LAS

b) Photomultipliers for item (b)

c) Holder for items (a) and (b), flange with feed through connectors 300 k yen

Total budget: 1.1 M yen

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SUMMARY OF THE PROPOSAL

Pairing correlations, influencing almost every feature of ground and low-lying states in nuclei, lie at the heart of nuclear physics. Understanding the mechanism of neutron-proton (*np*) pairing in $N=Z$ nuclei has been a long-sought goal in nuclear structure since the early sixties. Despite large efforts in both theoretical and experimental studies, the fundamental nature and the interplay between $T=0$ and $T=1$ pairs are still the subject of debate. Cross section measurement of *np*-pair transfer is considered as a sensitive probe for the dynamical implications of $T=0$ and $T=1$ pairing correlations. We propose a series of (p,³He) and (³He,p) transfer reaction measurements in normal kinematics on $N=Z$ nuclei in the *2s-1d* shell. The consistent set of accurate cross sections from the proposed systematic measurements spanning the *sd*-shell region are expected to provide insight into $T=0$ and $T=1$ *np* pairing collectivity and the mechanism of *np* pairing in these light nuclear systems. In addition, by comparing the cross sections from the proposed measurements to the predictions from the reaction framework coupled with structure model, we are able to evaluate the microscopic descriptions of *np* pairing correlations in this region. The results would serve as the foundation of the systematic studies of *np* pairing for heavier $N=Z$ nuclei.