Nishina Center　mini-WS/Symposium　Report

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Submitted Date:　2011 / 01 / 02
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Title	Probing Neutron-Proton Pair Correlations – pairing models, cross section measurements and reaction mechanisms	
HP address	http://indico.riken.jp/indico/conferenceDisplay.py?confId=285	
Date	November 19-20, 2010	
Summary of discussion and its advances (expected in the future)	See below	
About organizers: Name, Affiliation (Department)	Jenny Lee, Nori Aoi, Hiroyoshi Sakurai RI Phys. Lab., Nishina Center, RIKEN	
About Participants Name, Affiliation (Department)	Total: 47 people See below	
Supported expenses	（in total） ¥219,112	（breakdown） Coffee Break = ¥38,970 (Coffee: ¥ 33,600, Snacks: ¥5,370) Local Expense = ¥ 180,142 (Lodging expense: ¥ 140,942 (8 persons), Local Traffic expense: ¥ 39,200 (7 persons * ¥ 5,600)

＊Please attach other documents as needed.

Summary of discussion and its advances

Neutron-proton pairing correlations have been investigated with tremendous efforts. However, the nature and the interplay between T=0 and T=1 pairs are still the subject of debate because of the inconclusive experimental evidences from spectroscopy studies. In particular, the empirical fingerprint of T=0 pairing phase is not clear. This situation may be about to change with the intense N=Z radioactive beams which are becoming accessible through rare isotope accelerators worldwide. The high intense beams allow two-nucleon removal cross section measurements with sufficient statistics. Such new approach may constitute a sensitive probe for the dynamic implications and the role of T=0 and T=1 pair correlations. To obtain quantitative knowledge and consolidate theories based on this new methodology, it is essential to establish a framework for systematic cross section measurements coupled with theoretical structure and reaction mechanism studies. For this interdisciplinary project, strong collaborations among experimentalists and nuclear reaction theorists as well as structure theorists are important. This symposium is dedicated to uniting efforts and ideas from the community to establish the framework and road map to advance our understanding of neutron-proton pair correlations. Having speakers with different expertise exposing their work extensively followed by discussions in the symposium, we had made future plans on both experimental and theoretical actions as follows:

Approach/framework: Experimental tools are neutron-proton (*np*) pair knockout reaction and transfer reaction. Well-established reaction models of knockout and transfer mechanisms are needed to permit precise dynamical calculations for quantitative comparison of the theoretical cross sections to the measurements. Nuclear structure input to the cross section calculations is required in the reaction models. Since pair correlations are expected to have significant influence on the cross sections, the microscopic descriptions of *np* pair correlations in the wave functions from nuclear structure models can be evaluated.

Cross section measurements and the associated reaction models

I. Neutron-proton pair knockout reactions with ^{9}Be/^{12}C target:

Reaction theory: np-pair knockout reaction model has been recently developed. Exclusive cross section data are needed to verify the reaction formulism.

Experiments: (I) np-pair removal from ^{12}C may be the first nucleus for the systematic studies. (II) Proof-of-principle experiment is needed to establish and consolidate the experimental techniques for tagging the direct knockout reaction channel from the total cross sections. (III) Systematic measurements of np-removal from *f*-shell nuclei will be considered for quantitative understanding of

the nature and interplay of T=0 and T=1 *np* pairing. (IV) Systematic measurements of np-removal from N≠Z nuclei will also be considered for probing the delicate balance of n-p and n-n pair correlations.

II. Neutron-proton pair transfer reactions:

Reaction theory: Systematic studies of reaction mechanism based on the developed np-pair transfer reaction model will be proceeded to disentangle and quantify the effects of pairing correlations on transfer reaction cross sections.

Experiments: (I) np-pair transfer cross section measurements on even-even nuclei will be considered for systematic studies of T=0 and T=1 pairing correlations. (II) Two nucleon transfer reactions on *Sn* isotopes are under discussion.

Structure theory of pairing correlations

Cross sections result from strong interplay between reaction mechanism and structure. Sensitivity of different experimental probes to pair correlations needs to be quantitatively estimated. Some theoretical advances include: (I) Schematic model with and without neutron-proton pairing (II) Formulating mean-field model with neutron-proton pairing correlations. (III) Controlling neutron-proton pairing controlled by the operator of pairing interaction in the shell model prospective.

Other studies of np-pairing correlations

Fingerprints of np-pairing correlations on spectroscopic factors, symmetry energy and IBM mass predictions in N=Z nuclei are being discussed and studied.

Participants			
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*) Lodging expense supported

**) Local transport supported

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