Title: Search for the β^+ Gamow-Teller strengths in the continuum for (n, p) reactions at 300 MeV

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Experimental group:

Name	Institute	Status
Hide Sakai	Univ. of Tokyo	P
Atsushi Tamii	Univ. of Tokyo	RA
Kimiko Sekiguchi	Univ. of Tokyo	D1
Seitaro Sakoda	Univ. of Tokyo	M2
Yukie Maeda	Univ. of Tokyo	M1
Hiromitsu Kato	Univ. of Tokyo	M1
Michio Hatano	Univ. of Tokyo	M1
Hiroyuki Okamura	Saitama Univ.	AP
Kenji Suda	Saitama Univ.	M2
Kichiji Hatanaka	RCNP	P
Tomotsugu Wakasa	RCNP	RA
Junichiro Kamiya	RCNP	M2
Daisuke Hirooka	RCNP	M1
M.B. Greenfield	International Christian Univ.	P
Jack Rapaport	Ohio Univ.	P
Chris Morris	LANL	P

Running time:
7 days for the installation without beam
49 days for running

Beamline:
WS

Beam requirements:
polarized protons
energy: 300 MeV
intensity: as much as possible

Budget:
experimental expenses; 2,500 kyen
four times of travel

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Summary of the Proposal

The quenching of the Gamow-Teller (GT) strength has been one of the most interesting phenomena because quenching of the GT strength might give a signature of the non-nucleonic degrees of freedom. Two physically different mechanisms have been proposed for the quenching mechanism of the GT strength. One is the Δ(1232)-isobar nucleon-hole (ΔN^{-1}) admixture into the proton-particle neutron-hole $1p$-$1h$ GT state. According to this mechanism the missing strength is shifted to the energy region of Δ excitation. The other is the configuration mixing with the $2p$-$2h$ configurations. In this picture, the missing strength is shifted to the region of 20-50 MeV excitation energy. In order to solve this quenching problem, we have to identify the $L = 0$ component of the cross section ($\sigma_{\Delta L=0}$) in the highly excited continuum.

Recently, Wakasa *et al.* have measured the angular distribution of the double differential cross sections for the (p,n) reactions on ^{90}Zr ^{27}Al, and ^{208}Pb at 295 MeV. By performing the multipole decomposition analysis (MDA), the GT strength ($S_{\beta-} - S_{\beta+}$ value) of 90% and 84% have been identified in the continuum up to 50 MeV excitation in ^{90}Nb and ^{27}Si, respectively.

There are still several systematic uncertainties in the process of the analysis. The source of the uncertainties are 1) MDA, 2) MDA noise, 3) isovector spin-monopole, 4) GT unit cross section, and 5) β^+ strength. By measuring the (n,p) reactions at 300 MeV we can largely reduce these uncertainties except the GT unit cross section.

We propose to measure the angular distribution of the double differential cross sections and analyzing powers for the ^{90}Zr, ^{208}Pb, ^{27}Al(n,p) reactions at $E_p = 300$ MeV. By applying the MDA to the cross section data, we will identify the $\sigma_{\Delta L=0}$ in the continuum and deduce the B(GT) value. The measurements will be carried out with the Large Acceptance Spectrometer (LAS) at angles $\theta_{\rm lab}$ between 0.0° and 12.5°.