E428

RCNP EXPERIMENTE

PROPOSAL FOR EXPERIMENT AT RCNP

12 February 2014

TITLE:

Determination of precise mass and width of ^{5}H

SPOKESPERSON:

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EXPERIMENTAL GROUP:

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J. Zenihiro	RIKEN, Nishina Center	Research Scientist
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M. Tsumira	Kyoto Univ.	M2 student
S. Terashima	Beihang Univ.	Associate Professor

RUNNING TIME:

Test Run	2 days
Beam tuning and DAQ setup	1 day
Background Runs	2 days
Calibration Run	1 day
Data taking	8 days
Total	14 days

BEAM LINE: Ring : EN course

BEAM REQUIREMENTS:

Type of particle	^{7}Li
Beam energy	40*A* MeV
Beam intensity	100 enA or higher

BUGET REQUEST:

Transportation of drift chamber from Riken	200 kyen
Beam pipe and stage for drift chamber in F3	400 kyen
Target mounting flange and ladder	200 kyen
DSSD-CsI(Tl) telescope mounting	300 kyen
Total	1100 kyen

TITLE: **Determination of precise mass and width of ^{5}H**

SPOKESPERSON: Junki Tanaka , Isao Tanihata

SUMMARY OF THE PROPOSAL

We propose an experiment to determine the mass and the width of "super-heavy hydrogen" ^{5}H using (d,^{3}He) reaction in inverse kinematics, d(^{6}He, ^{3}He)^{5}H. The precise mass determination of ^{5}H provides important information on the existence/non-existence of "neutron-rich hypernuclei" $^{6}_{\Lambda}$H as a bound state. Experimentally a few events have been reported and suggested as possible candidates of a $^{6}_{\Lambda}$H bound state[1] [2]. In contrast, an experiment at J-PARC shows no evidence of $^{6}_{\Lambda}$H[3]. A theoretical study indicates $^{6}_{\Lambda}$H as a resonance state, if the presently known mass and width of ^{5}H are used[4]. However, present precision of ^{5}H mass is not sufficient to conclude the theoretical predictions clearly. Hence, the mass and width of ^{5}H are key observables to discuss $^{6}_{\Lambda}$H. Thus far, several experiments have reported the mass and the resonance width of ^{5}H, but the results are inconsistent and not precise enough to discuss $^{6}_{\Lambda}$H. Hence, the precise mass and the resonance width of ^{5}H are eagerly awaited.

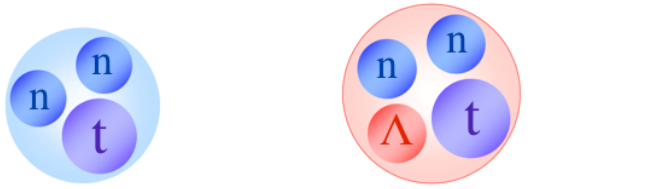

Fig.1 ^{5}H as "t+n+n"and $^{6}_{\Lambda}$H as "t+n+n+Λ"

Excited states of ^{5}H will also be studied with d(^{6}He, ^{3}He) reaction. The proton pick up reaction has a different selectivity to ^{5}H states from other reactions so far used to study ^{5}H reactions as listed later in Table 2.

Taking advantage of the intermediate energy unstable nuclear beam at RCNP and developed experimental techniques, we propose an experiment as follows.

The experiment will be performed at RCNP secondary beam line, EN course. 30*A* MeV ^{6}He (2×10^{5} cps) beam will be obtained from 40*A* MeV ^{7}Li (100 enA) primary beam, which is suitable energy for transfer reaction. The ^{6}He beam interacts with d in a CD_2 target, producing ^{5}H via d(^{6}He, ^{3}He)^{5}H reaction. The missing mass spectrum of ^{5}H is reconstructed from the energy and the scattering angle of ^{3}He. Our aim is to determine the mass of ^{5}H with precision better than 50 keV, and to measure the width of the state above 250 keV.