RIBF ULIC Symposium/mini-WS Report

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Summary of discussions and its (expected) results:

[Backgrounds]

Proton resonance elastic scattering for measuring the IARs has attracted attentions as a simple but a powerful way to determine the single particle structures of the neutron-rich nuclei. For the experiment with the radioactive ion beams, the thick target inverse kinematics method is used. In the method, one deduces the reaction energies assuming the elastic scattering kinematics, which means that there is a chance of mis-identification of the IAR if the inelastic scattering has a large cross section. In the workshop, we discussed the physics background of the inelastic channel as well as various ways to evaluate the channel.

[Discussions and Results]

The inelastic channel is a unique probe to overlap the wave function coupled to the excited state in the core nucleus. In the recent experiment of ^{4}He+^{6}He, FSU group observed that the cross section of the inelastic channel is as large those of elastic channel for a resonance, indicating that the resonance has a large overlap with ^{6}He(2^{+}). Exclusive measurement of the inelastic channel will give us new information on the nuclear structure.

In the next NP-PAC, we're going to propose a measurement of IARs of ^{33}Mg. An inelastic channel ^{32}Mg(p,p') which might be included in the ^{32}Mg(p,p) measurement. Teranishi-san presented an R-matrix calculation. The excitation function of the inelastic scattering has no interference of the Coulomb scattering so that the expected resonance shape would be sharper than those for the elastic scattering, which enables us to identify them easily. To make sure the elastic scattering, the angular distribution can be used. For the coming experiment, telescopes other than that at 0 degrees will be prepared to cover the large scattering angles.

As one of the ways to evaluate the inelastic channel, one can measure the de-excitation γ rays in

coincidence with outgoing protons. However, in the case of ^{7}Be+p reaction, the inelastic channel identified by reconstructing the invariant mass reported resonance while the result with the γ rays doesn't present any structure. Even though the statistical uncertainty for the case of measuring γ rays is larger than those for the other case, one would observe the resonance. It may be attributed to the large angular dependence, because the former one was measured at 170 degrees while the other was measured at 140 degrees. The R-matrix calculation of the inelastic channel at 170 degrees is on-going.

As a second way, one can use a thin gas target to make use of the travelling time of the beam. Though around 1 m H2 gas of 1 atm is needed, the method is most promising at this moment.

As a third way, the TPC type detector is under developing at TAMU to measure the inelastic channel exclusively. The TPC detector would be used in the future RIBF experiment. We agreed to keep in touch for the future collaboration.

Participants list(Name, Affiliation):

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Please attach other documents as needed.