In-beam γ-ray spectroscopy of Ne isotopes

K. Ishikawa,[*1] J. Gibelin,[*2] K. Yoshida, T. Nakamura,[*1] D. Beaumel,[*2] N. Aoi, H. Baba,[*4] Y. Blumenfeld, [*2] Z. Elekes, N. Fukuda, T. Gomi,[*4] Y. Kondo,[*1] A. Saito,[*4] Y. Satou,[*1] E. Takeshita,[*4] S. Takeuchi, T. Teranishi,[*3] Y. Togano,[*4] V. Lima,[*2] Y. Yanagisawa, A. M. Vinodkumar,[*1] T. Kubo and T. Motobayash

[NUCLEAR REACTIONS, Al(^{26}Ne,$^{26-x}$Ne*), Pb(^{26}Ne,$^{26-x}$Ne*), in-beam γ-ray spectroscopy, Coulomb dissociation]

We performed the study of the low-lying $E1$ strength of the neutron-rich ^{26}Ne nucleus by using the Coulomb dissociation and excitation reactions. The dipole strength is expected to be much more fragmented below the giant dipole resonance region[1]. In the case of ^{26}Ne, the low-lying excitation is suggested to be a pygmy of the giant dipole resonance. In this report, we present a preliminary result of the Coulomb excitation part in which we search for such resonance below the one-neutron emission threshold.

The experiment was performed at RIKEN Projectile-fragment Separator RIPS. The primary beam of ^{40}Ar at 95 MeV/nucleon bombarded a 2-mm-thick Be target to produce the secondary beam of ^{26}Ne. The average intensity and purity of the ^{26}Ne beam were about 6 kcps and 80%, respectively, with 58 MeV/nucleon just before the reaction target. The secondary beam was identified through energy loss and time-of-flight measurements. The scattering angles of incoming particles were determined by two PPAC's located upstream of the reaction target. Pb and Al targets having thicknesses of 230 mg/cm^2 and 130 mg/cm^2, respectively, were used for estimating the Coulomb and nuclear excitation components. Particle identification of the fragments passing through the target was performed using four-layer Si strip detectors composed of ΔE and E counters located at about 1.2 m downstream of the target. The first two layers were composed of 8 Si detectors which were used for position detection. The position and intrinsic energy resolution of ΔE counters were 5 mm and 2% (FWHM), respectively. The last two layers were the E counter composed of 8 Si(Li) detectors with 3 mm thickness, and an intrinsic energy resolution of 3% (FWHM). The neutrons produced in the reaction were detected by the neutron wall. The neutron wall had 4 layers located 3 m downstream of the target. Each layer had 29 plastic scintillators. The analysis of the neutrons is not used here and is reported elsewhere. The γ-rays emitted from outgoing nuclei were detected by 152 NaI detectors, DALI2. For 2 MeV γ-rays, the efficiency is calculated to be around 10% with an intrinsic energy resolution of 7% (FWHM).

A preliminary γ-ray spectrum for the ^{26}Ne + Pb reaction is shown in Fig. 1. The Doppler shift due to the velocity of ^{26}Ne is corrected for. We have observed a peak at 2020 keV corresponding to the excitation to the first 2^+ state. The $B(E2)$ of this transition was previously measured at MSU[2], so that we can use this excitation as a reference. Further analysis to extract the $E1$ strength below the one-neutron threshold is now in progress.

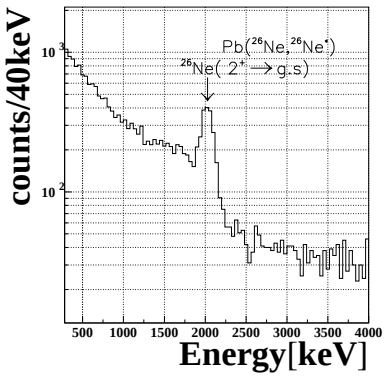

Fig. 1. Energy spectrum of Doppler-corrected γ-rays detected in coincidence with the ^{26}Ne ejectile. The peak at around 2020 keV is clearly seen.

References

1) A. Leistenschneider et al.: Phys. Rev. Lett **86**, 24(2001).
2) B. V. Pritychenko et al.: Phys. Lett. B**461**, 322(2001).

*1 Department of Physics, Tokyo Institute of Technology
*2 Institut de Physique Nuclaire, Orsay, France
*3 University of Tokyo (CNS), RIKEN Campus
*4 Department of Physics, Rikkyo University