New isotope of ^{39}Na and the neutron dripline of neon isotopes using a 345 MeV/nucleon ^{48}Ca beam

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The neutron dripline drawn between bound and unbound nuclei is important to verify the mass models and to understand nuclear structures. In 2014 experiment,[1)] a search for ^{33}F and ^{36}Ne isotopes was performed to determine the neutron dripline. The non-observation for these isotopes indicates that they are unbound.

In April 2017, the experiment (proposal number: DA16-01-01) was carried out, aiming to search the existence of a new ^{39}Na ($Z = 11$, $N = 28$) isotope as shown in Fig. 1 and to determine the neutron dripline for neon isotopes. High statistics data of ^{36}Ne isotope were also obtained to confirm the previous non-observation.

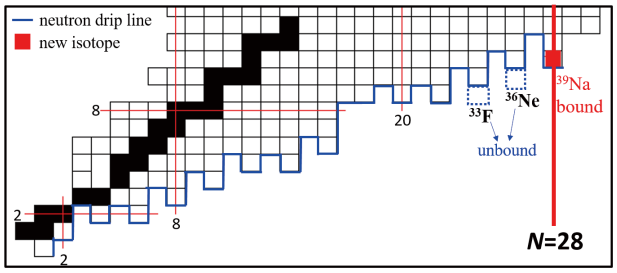

Fig. 1. New isotope of ^{39}Na with the neutron number N=28 and neutron dripline.

The neutron-rich neon and sodium isotopes were produced by the projectile-fragmentation of a ^{48}Ca beam with an energy of 345 MeV/nucleon at RIKEN RIBF. The high-intensity beam made it possible to search the neutron dripline. The magnetic rigidity (Bρ) of the first dipole magent using the BigRIPS[2)] separator was tuned for the ^{39}Na isotope. Two wedge-shaped degraders at the F1 and F5 dispersive foci were used to purify the RI beams. A thick collimator[3)] made of an SUS material with 50-cm thickness was installed at the F2 focal plane to reject tritons and other light particles. The different Bρ value was tuned for the ^{36}Ne isotope. The experimental conditions for ^{39}Na and ^{36}Ne settings are summarized in Table 1.

The particle identification (PID) was conducted using the TOF-Bρ-ΔE method.[4)] Figure 2 shows a preliminary PID plot for the ^{39}Na setting. The new isotope of ^{39}Na was clearly observed. The non-observation of any events corresponding to ^{38}Na indicates that it is unbound. In this experiment, we also determined the dripline of neon isotopes with a high confidence level. The detailed data analysis is currently in progress.

Table 1. Experimental conditions.

Settings	^{39}Na	^{36}Ne
Target	Be 20 mm	Be 20 mm
F1 degrader	Al 15 mm	Al 15 mm
F5 degrader	Al 7 mm	Al 7 mm
Bρ	9.155 Tm	9.4077 mm
Momentum acceptance	± 3%	± 3%

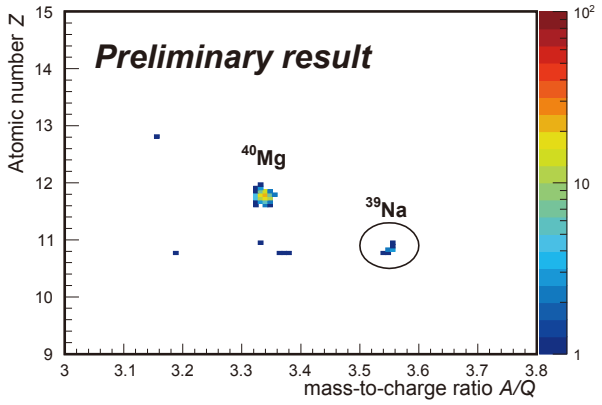

Fig. 2. Preliminary PID plot for the ^{39}Na setting.

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