Study of unbound oxygen isotopes $^{25}$O and $^{26}$O using SAMURAI

Y. Kondo,*1,+1,2 T. Nakamura,*1,+1,2 N. L. Achouri,*1,+1,2 T. Aumann,*4 H. Baba,*2 F. Delaunay,*3 P. Doornenbal,*2 N. Fukuda,*2 J. Gibelin,*3 J. W. Hwang,*5 N. Inabe,*2 T. Isobe,*2 D. Kameda,*2 D. Kanno,*1,+1,2 S. Kim,*5 N. Kobayashi,*1,+1,2 T. Kobayashi,*6,+2 T. Kubo,*2 S. Leblond,†3 J. Lee,*2 F. M. Marqués,*3 R. Minakata,*1,+1,2 T. Motobayashi,*1,+1,2 D. Murat,*7 T. Murakami,*8 K. Muto,*6 N. Nakatsuka,*8 T. Nakashima,*1,+1,2 A. Navin,*9 S. Nishi,*1,+1,2 S. Ogoshi,*1,+1,2 N. A. Orr,*4 H. Otsu,*2 H. Sato,*2 Y. Satou,*5 Y. Shimizu,*2 H. Suzuki,*2 K. Takahashi,*9 H. Takeda,*2 S. Takeuchi,*2 R. Tanaka,*1,+1,2 Y. Togano,*10,+13 A. G. Tuff,*11 M. Vandenbroucke,*12 and K. Yoneda*2

Unbound states of the neutron-rich oxygen isotopes $^{25}$O and $^{26}$O have been studied by the invariant-mass method by using SAMURAI1) with the aim to elucidate the mechanism of the neutron drip line anomaly in oxygen and fluorine isotopes. Another interesting topic is the possible two-neutron radioactivity of the $^{26}$O ground state, predicted by a theoretical study.2) Experimentally, only the upper limit of the ground-state energy3,4) and lifetime with a large error5) are currently available.

Details of the experimental setup are described in our previous report.6) Figure 1 shows a mass identification plot of outgoing $Z = 8$ charged particles observed in the breakup of $^{27}$F on a carbon target. Particle identification is performed by the $B\rho - \Delta E$-TOF technique. The magnetic rigidity $B\rho$ is determined by the positions and angles at the entrance and exit of the SAMURAI magnet measured by means of the MWDCs (BDC1.2 and FDC1.2). Combining the $B\rho$ value with energy loss $\Delta E$ and TOF measured by a plastic scintillator hodoscope (HODF), outgoing particles can be clearly identified. The mass resolution $\Delta A = 0.18$ (FWHM), corresponding to $13\sigma$ separation, is achieved for $^{24}$O.

Figure 2 shows a preliminary decay energy spectrum of $^{24}$O+n observed in the breakup of $^{27}$F. The sharp peak near the neutron decay threshold corresponds to the $^{26}$O ground state and the peak at approximately 0.8 MeV corresponds to the ground-state resonance of $^{25}$O. Since the obtained statistics is much larger than that obtained in the previous experiments3,4) a better constraint on the $^{26}$O ground-state energy can be obtained. Analysis is currently in progress.

![Fig. 1. Mass spectrum of outgoing $Z = 8$ particles in the breakup of $^{27}$F.](image1)

![Fig. 2. Decay energy spectrum of $^{24}$O+n in the breakup of $^{27}$F.](image2)

References