Isomeric RIB Production of Aluminum-26

H.Shimizu[a,e], D. Kahl[b], H. Yamaguchi[a], K. Abe[a], O. Beliuskina[a], S.M. Cha[c], K.Y. Chae[c], A.A. Chen[c], Z. Ge[e], S. Hayakawa[a], N. Imai[a], N. Iwasa[6], A. Kim[c], D.H. Kim[c], M.J. Kim[c], S. Kubono[e], M.S. Kawag[c], J. Liang[d], J.Y. Moon[h], S. Nishimura[e], S. Oka[a], S.Y. Park[a], A. Psaltis[a], T. Teranishi[a], Y. Ueno[a] and L. Yang[a]

[a]*Center for Nuclear Study, the University of Tokyo,* [b]*the University of Edinburgh,* [c]*Sungkyunkwan University,* [d]*McMaster University,* [e]*RIKEN Nishina Center,* [f]*Tohoku University,* [g]*Ewha Womans University,* [h]*Institute for Basic Science,* [i]*Kyushu University*

$^{26}\mathrm{Al}$ is known as the first specific radioactivity detected via characteristic β-delayed γ-ray by astronomical telescopes [1]. Despite a lot of effort over the past three decades, the particular production sites of galactic $^{26}\mathrm{Al}$ are not well understood and there is a discrepancy between observations and theories on estimated abundance of $^{26}\mathrm{Al}$ in the interstellar medium [2]. Its isomer, $^{26\mathrm{m}}\mathrm{Al}$, which is $J^{\pi} = 0^{+}$ and has a short lifetime of $6.35\,\mathrm{s}$ compared with the ground state, $^{26\mathrm{g}}\mathrm{Al}$, which is $J^{\pi} = 5^{+}$ and $T_{1/2} = 0.72\,\mathrm{Myr}$, may play an important role to the problem because it falls to $^{26}\mathrm{Mg}$ as super allowed Fermi transition and does not emit any γ-rays. The two states, $^{26\mathrm{g,m}}\mathrm{Al}$, are suggested to be in transition and in thermal equilibrium by thermal photons via low-lying 1^{+} state, at least in extremely high temperature environments, such as a supernova [3]. However the experimental information on the isomer is poorly examined and thus was requested for further experimental study by stellar modelers. The RI beam production of $^{26\mathrm{m}}\mathrm{Al}$ is a step to approach the puzzles of the abundance under the equilibrium. We will present an overview of the experiment to produce the isomeric RI beam of $^{26}\mathrm{Al}$ and measure proton elastic resonant scattering with a thick target in inverse kinematics by using the Center for Nuclear Study low-energy radioactive ion beam separator (CRIB [4]), located at RIKEN Nishina Center.

References

[1] S. Plüschke *et al. The COMPTEL 1.809 MeV Survey*, arXiv preprint astro-ph **0104047** (2001)

[2] R.H Diehl *et al. Radioactive* $^{26}\mathrm{Al}$ *and Massive Stars in the Galaxy*, arXiv preprint astro-ph **0601015** (2006)

[3] R.C.Runkle, A.E.Champagne and J.Engel, *Thermal Equilibration of* $^{26}\mathrm{Al}$, The Astrophysical Journal **446**:970–978 (2001)

[4] Y. Yanagisawa *et al. Low-energy radioisotope beam separator CRIB*, Nuclear Instruments and Methods in Physics Research Section A: Accelerators, Spectrometers, Detectors and Associated Equipment **539(1)**:74–83 (2005)