Contribution ID: **15** Type: **Poster**

Lifetime measurements of excited states in the weakly-bound nucleus 17C

Thursday, 3 April 2008 18:20 (20 minutes)

Lifetime measurements have been performed for excited states in the neutron-rich carbon isotope 17C. Recently, several experimental studies have been dedicated to investigate the low-lying structure of 17C, revealing a couple of unique features inherent in the weakly-bound states located below the extremely low neutron emission threshold at 730 keV. The spin-parity of the ground state was assigned to be 3/2+ [1,2], which is in contradiction with the naive shell model expectation that the ground state of an odd nucleus with N=11 should have the spin-parity of 5/2+. Close to the anomalous ground state, two excited states were found to be almost degenerate at excitation energies of about 220 keV and 330 keV, respectively [3]. In contrast with the degeneracy, however, a large asymmetry of the excitation cross-sections was observed in a study using proton inelastic scattering [4], where the excitation strength for the first excited state is much smaller than that for the second excited state. These experimental findings suggest an emergence of an intriguing structure in the low-lying states of 17C.

The present work aims to elucidate the low-lying structure of 17C by studying the electromagnetic transitions between the bound states. The electromagnetic deexcitation strengths for the first and second excited states have been determined by means of the gamma-decay lifetime measurements. We successfully conducted the measurements by employing the recoil shadow method (RSM) with intermediate-energy radioactive-isotope beams [5,6].

The experiment was performed at the RIPS facility in RIKEN. In the present study, we populated the excited states of 17C by break-up reactions of 18C at 79 AMeV on a 9Be target. A 110-AMeV 22Ne primary beam impinged on a 1.02-g/cm^2 9Be production target for projectile fragmentation reactions. A high-intensity 18C beam of about 2.3x10^4 counts per second was obtained, and directed onto a 370-mg/cm^2 9Be reaction target set at the final focal plane of RIPS. Outgoing particles were detected and identified by means of the TOF-dE-E method using a plastic scintillator hodoscope, located 3.8 m downstream of the target. The deexcitation gamma rays were detected by 130 NaI(Tl) detectors in coincidence with scattered 17C particles. Energy thresholds of the detectors were set to as low as 150~200 keV for gamma rays in the projectile frame. In order to implement the RSM, a 5 cm-thick lead slab was installed close to the secondary target.

In the present talk, the measured lifetimes of the first and second excited states will be presented. The reduced electromagnetic transition probabilities for the two deexcitations will be discussed in relation to the low-lying structure of 17C.

References

[1] J. P. Dufour, et al., Z.Phys. A324 (1986) 487.
[2] H. Ueno, et al., Nucl.Phys. A738 (2004) 211.
[3] M. Stanoiu, et al., Eur.Phys.J. A20 (2004) 95.
[4] Z. Elekes, et al., Phys.Lett. B614 (2005) 174.
[5] N. Imai, et al., Phys.Rev.Lett. 92 (2004) 062501.
[6] H. J. Ong, et al., submitted to Physical Review C; arXiv:0711.4062 [nucl-ex].

Primary author: Mr SUZUKI, Daisuke (Department of Physics, University of Tokyo)

Co-authors: Dr BABA, H. (RIKEN); Dr IWASAKI, H. (Department of Physics, University of Tokyo); Dr ONG, H. J. (Department of Physics, University of Tokyo); Dr SAKURAI, H. (RIKEN; Department of Physics, University of Tokyo); Dr KURITA, K. (Department of Physics, Rikkyo University); Dr ISHIHARA, M. (RIKEN); Mr SUZUKI, M. K. (Department of Physics, University of Tokyo); Dr AOI, N. (RIKEN); Dr IMAI, N. (RIKEN); Dr BISHOP, S. (RIKEN); Mr OTA, S. (CNS, University of Tokyo); Dr TAKEUCHI, S. (RIKEN); Mr ONISHI, T. K. (Department of Physics, University of Tokyo); Dr KUBO, T. (RIKEN); Dr MOTOBAYASHI, T. (RIKEN); Dr NAKAMURA, T. (Department of Physics, Tokyo Institute of Technology); Mr NAKAO, T. (Department of Physics, University of Tokyo); Mr OKUMURA, T. (Department of Physics, Tokyo Institute of Technology); Mr ICHIKAWA, Y. (Department of Physics, University of Tokyo); Dr KONDO, Y. (Department of Physics, Tokyo Institute of Technology); Mr TOGANO, Y. (Department of Physics, Rikkyo University); Dr YANAGISAWA, Y. (RIKEN)

Presenter: Mr SUZUKI, Daisuke (Department of Physics, University of Tokyo)

Session Classification: Poster

Track Classification: Collectivities and shell effects in neutron/proton-rich nuclei