



Contribution ID: 79

Type: **Invited**

Laser and mass spectroscopy at SLOWRI of RIKEN RIBF

Monday 15 December 2014 09:35 (25 minutes)

A universal stopped and low-energy RI-beam facility (SLOWRI) [1] is finally being installed at RIKEN RIBF. It will convert relativistic RI-beams from the in-flight separator BigRIPS to low-energy, low-emittance, high-purity RI beams using two different gas catcher cells: RF-carpet gas cell and PALIS gas cell [2, 3]. The former is a 1.5-m long cell filled with 100 mbar He gas and operated at 77 K cryogenic temperature. It will be placed at the exit of D4 magnet of BigRIPS to accept main beams from BigRIPS. The thermal ions in the large cell can be transported quickly toward the exit by a large RF-carpet [4, 5] with the ion-surfing method [6, 7, 8]. The latter cell will be placed in the vicinity of F2 focal plane of BigRIPS where unused RI-beams were simply abandoned. The cell is 30 cm long and filled with 1 bar Ar gas in which most thermal ions quickly become neutral. The neutral RI atoms can be transported by a gas flow toward the exit where resonant laser radiations re-ionize the atoms selectively. This gas cell will be used concurrently with the other BigRIPS experiments so that parasitic low-energy experiments can be carried out everyday.

The extracted RI-beams from the gas cells will be mass separated by dipole magnets at 30 keV and the beams will be merged into a single beam line leading to the experimental room where various precision spectrometers such as a multi-reflection time-of-flight mass spectrograph [9, 10, 11], ion traps [12, 13] and a collinear laser spectroscopy apparatus will be placed and users can access the room without any restrictions. Many experiments and tuning the spectrometers can be conducted daily using the parasitic beam; the main beam will be required only when very rare isotopes are studied.

At SLOWRI, various precision spectroscopy experiments will be performed. One is laser spectroscopy for the electromagnetic ground state properties of exotic nuclei, especially for so-called 'difficult' elements which are not available at originally ISOL facilities. The other is precision mass measurements with the MRTOF mass spectrograph. It will be able to determine multiple nuclei simultaneously when directly coupled with gas catcher at BigRIPS.

[1] M. Wada et al., *Hyp. Int.* 199 (2011) 269.

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[4] M. Wada et al., *Nucl. Instr. Meth.* B204 (2003) 570.

[5] A. Takamine et al., *Rev. Sci. Instr.* 76 (2005) 103503.

[6] G. Bollen, *Int. J. Mass Spectrom.* 299 (2011) 131.

[7] M. Brodeur et al., *Int. J. Mass Spectrom.* 336 (2013) 53.

[8] F. Arai et al., *Int. J. Mass. Spectrom.* 362 (2014) 56.

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Session Classification: Facilities