Development of Atomic Beam Resonance Method with RI beams

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Spin-polarized radioactive (RI) beam is a useful tool for studies of nuclear physics, fundamental physics, and material science. A production method of highly-polarized low-energy RI beams by atomic beam resonance method (RIABR) is being developed. By combining the variety of the intense RI beam produced by projectile fragmentation (PF)-reaction and the RIABR method, the low-energy polarized RI beams are expected to be produced for the various isotopes [1].

Atomic beam for the ABR method should have low energy and low temperature. The RI beam produced by the PF reaction, on the other hand, has too high energy and has too large momentum width for the ABR method. Thus the incoming RI beam is decelerated by an energy degrader and installed into a gas cell filled with a noble gas to stop in the cell. The stopped isotopes tend to have +1 charge in the noble gas, and are drifted by an electric field to an extraction area where the drifted RI ions are guided into evacuated area through a nozzle with thermal velocity. The extracted RI ions are then neutralized and transported to magnet system for spin selection.

The equipment required to be developed is mainly divided into i) stopping gas cell including an electrode system and extraction nozzle, ii) neutralization system, and iii) spin selection system. The gas cell system which involves the electrodes was developed and several measurements were conducted with this system [2,3]. We will report on the on-line experiment to measure sopping/drifting efficiency of the incoming RI beam, and future plan to realize the RIABR method.

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[2] K. Shimada *et al., Proc. Int. Sympo. on A New Era of Nuclear Structure Physics* (Singapore: World Scientific) p.363.
[3] D. Nagae *et al., Physica* E **29**, 580 (2005).