RCNP SEMINAR

Research Center for Nuclear Physics, Osaka University

Speaker Prof. Stephan Ettenauer (for the TITAN collaboration)

Title Nuclear Structure studies and Test of Fundamental Symmetries at TITAN/TRIUMF

Time&Date 15:00 -16:30, May 18 (Mon) , 2010

Place Lecture room, 4th floor , RCNP, Osaka University

Abstract

The mass is one of the most fundamental properties of atoms and provides access to many of the key questions in nuclear physics. As it reflects the binding energy of a bound system, precise experimental knowledge about nuclear masses is essential for developing models of nuclear forces. A particular challenge for theoretical descriptions are exotic phenomena such as halo nuclei in which loosely bound nucleons orbit a nucleus' core.

Furthermore, tests of fundamental symmetries such as the verification of unitarity of the CKM matrix also rely on precisely measured transition energies and, thus, on nuclear masses.

Penning traps, well known for their unprecedented precision in stable nuclides, have now become the tool of choice for mass measurements of radioactive nuclides. TRIUMF's Ion Trap for Atomic and Nuclear Science (TITAN) at ISAC / TRIUMF is a Penning trap mass spectrometer which is uniquely capable to perform high precision measurements on very rare and short-lived nuclides. This was demonstrated with the two neutron halo nucleus 11Li (T1/2=8.8ms).

For the unitarity test of the CKM matrix, the limit of precision needs to be pushed further to achieve $\delta m/m \approx 1 \cdot 10\text{-}9$ even for nuclides with half-lives below 100 ms. At TITAN, this is accomplished by utilizing an Electron Beam Ion Trap (EBIT) to boost the charge state of an ion and, thus, the precision of the measurement.

In this talk, results for halo nuclei of He, Li, and Be isotopes will be shown. In addition, first successful tests on radioactive, charge bred ions will be presented.