The TITAN facility at TRIUMF: precision experiments with ion traps

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Rm 124 NSH

TRIUMF's Ion Trap for Atomic and Nuclear science (TITAN) facility deploys three ion traps for Penning trap mass spectrometry of radionuclides and in-trap decay spectroscopy. The former focuses on very short-lived species, such as the halo nuclide ^{11}Li and more recently in a detailed survey of the island of inversion at $N = 20$. The latter has revealed the lowest shell gap of any magic nuclide (in ^{32}Mg) and the only known overlap in two-neutron separation energies on the chart of nuclides (at $N = 21$). Q-value measurements were performed to elucidate the so-called gallium anomaly in neutrino physics, in which the observed and expected solar neutrino fluxes are discrepant. To investigate nucleosynthesis via the r-process mass measurements near $A = 100$ were performed on neutron-rich Rb and Sr isotopes.

Prior to the mass measurement, the Rb and Sr isotopes were charge bred in an electron beam ion trap (EBIT), which is playing an increasingly important role at TITAN. Originally, constructed to reduce beam-time requirements, the EBIT has been used to improve beam purity (e.g. threshold charge breeding), to accumulate ions (ion stacking), to recapture charged decay products, and for in-trap decay spectroscopy. The last has been directed toward the measurement of branching ratios of intermediate nuclides of double electron-capture candidates. The magnetic field separates the charged and neutral decay particles, thereby eliminating the background from annihilating β particles. The electron beam enhances the radial confinement, extending the observation period to minutes. For x-ray detection seven Si(Li) detectors are placed radially around the EBIT. An overview of the ion manipulation techniques and the facility will be given as well as highlights from the research program.

Refreshments served prior to the seminar in Rm 124.