



# Nuclear Astrophysics with the Canadian Penning Trap Mass Spectrometer at the Argonne National Laboratory

- The formation of the elements that make up our universe, from the remnants of the big bang that created it, is a fascinating conundrum. Some success has been achieved in the explanation of the production of the light isotopes but the mechanisms responsible for the production of the bulk of the heavier elements are still not clear. Normal, quietly burning stars can not reproduce the observed abundances for the elements in the universe today. It is thought that a large part of the production of these elements takes place in explosive astrophysical events like supernovae and x-ray bursts. The nuclear reactions powering these events follow paths among short-lived, radioactive nuclides at the limits of nuclear binding and produce the heavier nuclides. The atomic masses of these nuclei are essential because they determine the energy released and determine the path of the nuclear reaction chains ( $r$ -,  $p$ -  $\nu p$ -processes) that take place in these events.
- The Canadian Penning Trap mass spectrometer (CPT) is designed to accurately measure the masses of a wide variety of these short lived, exotic nuclei with great accuracy and sensitivity. The CPT currently operates on line to the Argonne Tandem Linac Accelerator System (ATLAS) at the Argonne National Laboratory (ANL). With this apparatus precise atomic mass measurements are possible on a wide variety of proton- and neutron- rich isotopes with half-lives as low as 30 ms.
- This summer the CPT will start operation on-line to the new CARIBU facility at ANL where it will have the unique and exciting opportunities to study extremely neutron-rich nuclei produced with an intense,  $^{252}\text{Cf}$ , fission source. Numerous exciting projects are available.

Explore nuclear astrophysics in the great city of Chicago.

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