Argonne National Laboratory

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ATLAS (Argonne Tandem Linear Accelerator System): The national user facility for nuclear structure research

The ATLAS facility is the US user facility for nuclear physics research at low energies, in the vicinity of the Coulomb barrier. It provides a wide range of beams for nuclear reaction and structure research to a large community of users from the US and abroad. The full range of all stable ions can be produced in ECR ion sources, accelerated in the world's first superconducting linear accelerator for ions to energies of 10-20 MeV per nucleon and delivered to one of several target stations. About 20-40% of the beam time is used for physics with radioactive beams obtained either by in-flight production or through the recently commissioned CARIBU facility. These exotic beams are used mostly to address forefront issues in nuclear astrophysics, nuclear structure and stockpile stewardship.

User community

ATLAS provides beams and experimental instruments for a large community of nuclear scientists. Yearly, 350-400 users, including on average 95 graduate students, carry out experiments at ATLAS. Typically, research at ATLAS results in 10 -15 Ph.D. theses and 60 - 80 publications in peer reviewed scientific journals every year. Beam time is allocated based on the recommendations of a Program Advisory Committee which meets twice a year.

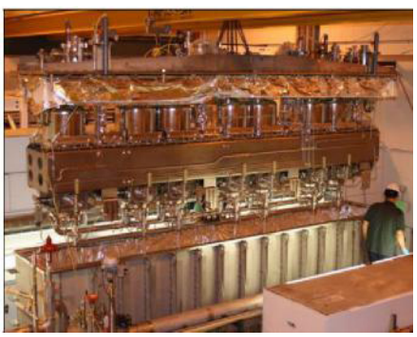
GAMMASPHERE is one of the forefront instruments available for experiments at ATLAS. It consists of 110 Compton-suppressed Ge detectors used to detect gamma rays emitted from compound nuclei formed by fusion of accelerated heavy ions and target nuclei.

Research programs

The ATLAS research programs focus on the key questions that are central to our understanding of baryonic matter and on the description of the astrophysical processes that generate energy and produce elements in the stars. These areas of research have been endorsed in several major reviews of the science. Specific issues being addressed are 1) the quantum shell structure of nuclei, 2) the evolution of nuclear structure as a function of neutron excess, 3) exotic decay modes, 4) masses of exotic nuclei, 5) fundamental symmetries, 6) nuclear reactions of astrophysical importance, 7) properties of the heaviest nuclei and 8) accelerator mass spectrometry.

Recent Facility Upgrades

Since its inception in 1985, the ATLAS facility has continually been upgraded in order to remain at the forefront of nuclear research. The recently commissioned Californium Rare Ion Breeder Upgrade (CARIBU) provides for the acceleration of neutron-rich fission fragments from a one Curie ^{252}Cf source to study neutron-rich nuclei, particularly those of relevance for the astrophysical rapid neutron capture process responsible for the production of a large fraction of the heavy elements in the Universe. As part of an ARRA-funded efficiency and intensity upgrade of ATLAS, a new cryostat of superconducting resonators with world-record accelerating fields and a room-temperature radio-frequency quadrupole have been installed in 2013. A new gas-filled spectrometer, AGFA, is under construction and an improved separator for the production of radioactive beams by an in-flight technique is under development. Both will bring unique capabilities worldwide for the study of exotic isotopes.



New superconducting cavities being installed as part of the ARRA funded efficiency and intensity upgrade of ATLAS. These new cavities have reached record breaking accelerating field for this velocity regime.

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