

Two NSF grants for the NIU ATLAS team

The ATLAS team at NIU has received two research grants adding up to \$930,000 by the National Science Foundation: \$510,000 to Prof. Dhiman Chakraborty and \$420,000 to Prof. Jahred Adelman. Both are single-PI grants for the three-year period starting 01 Aug, 2015. Together with a third grant of \$840,000 awarded to Profs. Zutshi, Hedin and Blazey, for the same period, they bring the total 3-yr funding of the High Energy Physics program from the NSF's highly competitive base program to \$1.77M, which is more than twice the \$874,000 received in a single grant to Chakraborty, Hedin and Zutshi during the prior 3-yr period. Even as the total number of PI's and co-PI's went up from 3 to 5, this is a remarkable growth at a fiscally challenging time when HEP programs at many other universities are experiencing cuts in their funding. While reflecting well on the NIU HEP program's track record in research productivity, this also comes with high expectations to live up to.

ATLAS is one of two general-purpose experiments to study proton-proton collisions at up to 14 trillion electron-volts at the Large Hadron Collider. Located in Geneva, Switzerland, and operated by CERN, the European Center for Research in Nuclear (and Particle Physics), the LHC collides particles at the highest energies ever achieved at a man-made facility. The ATLAS detector is optimized to study the outcome of those collisions. The objective is to understand the working of Nature at its most fundamental level by re-creating, for fleeting instants and in tiny volumes of space, conditions of unimaginably high densities and temperatures that the universe evolved through mere femtoseconds after the Big Bang (a femtosecond is a millionth of a billionth of one second). Together with its sister experiment CMS at the LHC, in 2012 ATLAS discovered the Higgs boson, which had been hunted relentlessly by numerous experiments around the world since it was first postulated by theorists more than 50 years before. Following the experimental verification, some of those theorists were awarded the Nobel prize in Physics in 2013.

The ATLAS detector, which took an international team of scientists, graduate students, engineers, and technicians nearly two decades to design, build, and get running, has the shape of a barrel almost as long as an Olympic swimming pool and half as much in diameter. With data pouring out of its 100 million electronic channels, the 7000-ton apparatus surrounds a collision point on LHC's 17-mile long circular ring, which sits 100 metres underground. ATLAS' superfast electronics and computing systems are capable of examining the outcomes of billions of collisions every second in minute details to search for phenomena that are extremely rare even at such high energies. The ATLAS collaboration currently counts among its members some 3,200 individuals from 176 institutions representing 38 countries. USA alone accounts for nearly a fifth of the membership. The NIU ATLAS team currently consists of two faculty members (Adelman, Chakraborty), one senior research scientist (Yuri Smirnov), one post-doctoral research associate (Nancy Andari), four PhD students (Blake Burghgrave, Puja Saha, Tyler Burch, Marc Pavlik) and one undergraduate student (Lauren Elder). Several other researchers at all levels have been involved over the past eight years, including three PhD students who have graduated.

NIU joined ATLAS under Chakraborty's leadership in 2006. The group's activities include key roles in the operation of the Tile Hadronic Calorimeter, an important subsystem of the complex detector that is used to measure energies of certain types of particles, and searches for new phenomena at the energy frontier through the top quark and Higgs boson sectors. ATLAS has since been a key component of NIU's overall HEP program funded by the NSF. In recent years, the group has been receiving an additional \$150,000/yr grant from NSF for ATLAS operations, which is expected to continue to grow at a modest rate over the next several years. The new grant will allow the group to hire another post-doctoral research associate to enhance its capabilities and facilitate supervision of students stationed at CERN.

Joining NIU in fall 2014, Adelman brought with him several years of experience on ATLAS as a post-doctoral researcher at Yale. Now the deputy leader of the NIU ATLAS team, he spearheads NIU's

participation in the Fast TracKer (FTK) upgrade - a project designed to dramatically improve the detector's ability to extricate signal from a noise-dominated deluge of data by real-time tracking of charged particles traveling at speeds close to that of light. Together with other members of his group, Adelman is also deeply involved in using the Higgs boson to probe and test the Standard Model of particle physics. Winning a single-PI award of this size in one's first year in a keenly contested competition is no mean feat. It will enable Adelman to continue and further energize the program that he has initiated with his start-up funds from NIU.

Components directed by Adelman and Chakraborty mesh very well, complementing each other in several aspects of a well-balanced institutional role for NIU - specifically on ATLAS, but more generally on the international arena of research in basic science at the world's foremost laboratory, where scientists from some 70 countries collaborate to use unique instruments to explore uncharted territories of Nature's vast expanse. Beyond gains in scientific knowledge, the technologies developed lead to momentous advances in a wide range of areas that touch our everyday lives - from medical science to information technology, finding new sources of clean energy to developing new materials, modeling financial markets to the fight against terrorism (the world-wide-web was born at CERN). Last, but not the least, it serves as a wonderful example of productive collaboration across national boundaries, promoting world peace at a time when its importance cannot be overstated.

The ATLAS program puts NIU in good company among virtually all other major research universities in the US and abroad that have a strong presence in Physics. It provides NIU students with access to research facilities, and the opportunity to train and compete with their peers, both of which are among the world's best. All NIU graduate students on ATLAS have done very well so far. Not only are they involved in all aspects of the team's research program, but also entrusted with roles of considerable responsibility in mission-critical day-to-day operation of the ATLAS detector and processing of data collected with it. All former students, who have completed their PhD's, received prestigious competitive awards from NIU and outside.

Adelman and Chakraborty, together with fellow High Energy Physicist Prof. Michael Eads, also serve as co-mentors at the NIU center of the nationwide QuarkNet outreach program. Funded jointly by the NSF and DOE (US Department of Energy) and with centers at 50+ universities and national laboratories, QuarkNet reaches out to High School teachers and students in a variety of ways - from lectures to hands-on experimentation at week-long clinics and summer internships - to promote interest in scientific research. Since Chakraborty initiated NIU's participation in QuarkNet in 2008, it has been highly successful in attracting several high schools to a variety of events and opportunities - from lectures to hands-on experimentation at week-long clinics, STEMfest to summer internships - every year.

For more information, see
<http://nicadd.niu.edu/atlas/>
<http://nicadd.niu.edu/quarknet/>