Education

The graduate program in nuclear physics at IU encompasses the three major areas covered by this research grant together with a complementary program in Many-Body Nuclear Dynamics run by Vic Viola and Romualdo DeSouza of the Chemistry Department, with a focus on studies of the liquid and gas phases of nuclear matter. During the period of the current grant there have been 21 different graduate students supported for all or part of the time, with 8 of them receiving their Ph.D. degrees during this period. The transition from research centered on the local facilities to the current outside user mode has presented new challenges in graduate recruitment. The group has worked very hard to advertise the new opportunities in Nuclear Physics at IU and this is beginning to pay dividends. As part of this effort the group has played a major role in graduate student recruitment, with Mike Snow in particular providing the driving force behind vigorous and extensive new recruiting efforts by the Physics Department as a whole. An important part of our recruitment efforts is the annual Graduate Student Visitation Day, where students who have been admitted to the program, but have not yet accepted our offer, are invited to spend a day visiting the Physics Department, with half the time spent at IUCF, culminating in an informal reception at IUCF with prospective students mixing with faculty and staff. Offers have been made to all qualified minority and female applicants, though we expect our success rate in attracting these candidates to improve markedly with our recent hire of minority and female faculty members in nuclear physics.

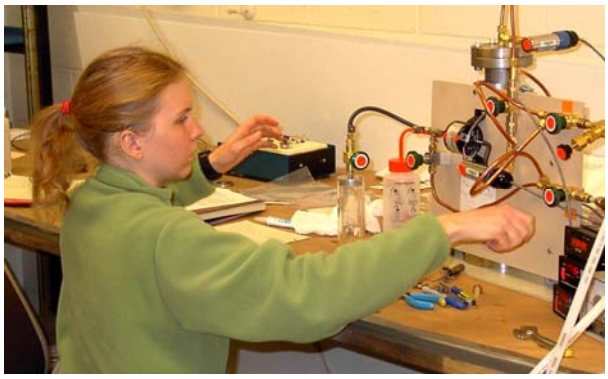
Students who have passed the Department qualifying exam and are spending most of their time on research have their progress monitored annually by a committee consisting of three of the faculty in this group. The committee findings are then discussed by the group as a whole and, if deemed necessary, feedback is provided to the student regarding ways to improve his/her progress toward the degree.

Both past and present students from the group have received several special awards during the past three-year period. Todd Peterson, who received his Ph.D. in 2000 for the development of the tagged neutron facility at the IUCF Cooler, went on to exploit the experience he gained in state-of-the-art solid-state detector technology in a post-doctoral appointment with a medical imaging group at the University of Arizona. His research there and his potential earned him one of a few nationally awarded Burroughs-Wellcome Fund Career Awards at the Scientific Interface, carrying $0.5M of research support starting in 2002. Peterson has since gone on to a faculty position in the Institute for Imaging Science at Vanderbilt University, where he is using his training in experimental nuclear physics to develop miniaturized detectors for *in vivo* medical imaging. In more recent achievements, Mike Gericke was awarded the William Koss award for the best overall graduate student in the IU Physics department in 2004, and was also nominated for an IEEE Radiation Instrumentation Early Career award. Mike was awarded a certificate for outstanding achievement and has been invited to Rome to receive this. Dan Hussey was selected to attend the DOE Nobel Laureate Conference in Lindau, Germany and has also received a National Research Council post-doctoral award.

The grant currently supports five post-docs (see photo at right), two of whom are female. Post-doctoral associates are encouraged to work on more than one project and to broaden their background and experience in preparation for future employment in physics research. At the end of their

first year each post-doc has an extensive interview with three members of the group, who review the post-doc's work and discuss potential career paths. Beginning in 2003 the group decided to offer one special post-doctoral position per year, named in honor of Larry Langer, who performed pioneering research at IU on beta decay and neutrino mass measurements. This position offers a higher salary and an allowance for research to encourage especially promising candidates at an early point in their career. The first Langer post-doctoral fellow, Chris Polly (Ph.D. from Illinois on the muon g-2 experiment), has just joined the group.

The nuclear physics faculty and staff are equally dedicated to providing undergraduates with research and technical training, in order to instill in them the excitement of discovery at a critical time in their careers. This includes undergraduates both from Indiana University and from other institutions through several programs. About 10 IU physics and chemistry undergrads are involved each year in research and development activities at IUCF. After graduation typically half of these students enter graduate school in physics/chemistry or some other scientific field. One recent example is Sara Breitzmann who worked with the IUCF neutrino group in 2001-2002 (see photo above). Working with H.-O. Meyer, she measured the solubility of gases in the MiniBooNE mineral oil, leading to a MiniBooNE technical note and presentation to the Collaboration. She has gone on to graduate studies in accelerator physics with S.Y. Lee at IU.



The Nuclear Physics faculty play a significant role in undergraduate education teaching and mentoring activities in the Physics Department, including design of new undergraduate laboratory courses and leadership of the Physics Club. The latter organization of undergraduate majors fosters extracurricular activities related to physics and astronomy. For example, members of the club perform the wildly popular annual demonstration-lecture at the IU Physics Department Open House. They also take an annual tour of a physics-related site (e.g., FNAL or ANL), judge for contests in the annual Science Olympiad held at IU, and host occasional statewide meetings. Mike Snow and Rex Tayloe are the faculty advisors for this program.

Traditionally, the Advanced Physics Laboratory course (P451/551) has been taught by nuclear physicists (Pollock, Schwandt, Vigdor, Nann, Wissink, Tayloe and Meyer). Consequently, a number of the available experiment setups deal with nuclear physics topics (beta decay, Mössbauer effect, gamma spectroscopy, neutron activation studies, cosmic ray measurements) and the course has benefited substantially from equipment loans from IUCF. H.-O. Meyer has played the leading role in revitalizing and completely overhauling both this course and the Intermediate Lab course (P309). These lab courses are mandatory for our physics majors and the graduate course (P551) is required of the department's graduate students. Several members of the group are furthermore contributing to the development of a new graduate-level seminar course in Experimental Methods in Subatomic Physics, being taught for the first time in Fall 2004.

IUCF also hosts a very successful NSF-REU program. Each year, about a dozen undergraduate physics majors, mainly from schools outside IU, are selected from a pool of about 50 applicants. They spend 10 weeks at IUCF working on individual research projects with a member of the IUCF faculty or staff. In addition to fundamental research in nuclear physics and accelerator physics, these projects include interdisciplinary research activities in medical physics and radiation effects. Examples of REU projects from the most recent summers are the design and implementation of magnetic shielding for the neutron spin rotation experiment and development of a 3D magnetic field mapping system. Each year, several of our REU students are selected to

present a poster about their research at the Fall Meeting of the DNP as part of the Conference Experience for Undergraduates (CEU) activity. This program is now in its seventeenth year of operation with over 240 alumnae (28% of whom are female).

The NSF-REU program will continue in the future as a joint REU site that includes both IUCF and the IU Physics Department, with 7-8 students working on projects at IUCF. We are working with an evaluation specialist from the IU School of Education, Prof. William Harwood, who has submitted a proposal to the NSF for a research project, entitled "Understanding Undergraduate Research Experiences at a Research University," that will explore the impact of these undergraduate research experiences. In addition, we are part of a new proposal for an REU site partnership that will bring minority students and their teachers to IU Bloomington.