

# Newsletter

MSU Physics and Astronomy Department

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Engineering Center grant from the NSF. We're also embarking on major programs at the Advanced Photon Source at Argonne National Laboratory and have begun significant research efforts in what has come to be known as "quantitative biology". Finally, the department has, after many years of trying, found a permanent astronomical home for optical and infrared astronomy. We have joined a consortium to construct a 4m telescope in Chile which should be completed by 2002. All of these efforts demonstrate the significant degree to which we're continuing to excel in our research during time of difficult overall funding. We've hired a number of excellent young faculty in all areas and they have taken on their responsibilities with enthusiasm. In this and subsequent issues, we'll endeavor to describe our research efforts in detail through short articles by the faculty involved.

One of the big stories for us is that after a half century we have begun construction of a new building to be located on south campus. This will be a fantastic structure for research and teaching. Wayne Repko has a short article in this issue with more detail. Please note drawings on the back of this letter.

After an all-time high in 1991 of 170 graduate students, we are currently supporting 125 as TA's and RA's. It's no secret that we, like most physics departments, are actively searching for good students as our research programs are easily able to support more. We've recently reviewed the entire graduate program and have significantly altered our examination procedures and have coordinated our basic graduate course content. We have similarly reviewed our undergraduate major program and are considering the introduction of a series of applied degree options in concert with other departments on campus. I anticipate an external review of this particular effort and may be contacting some of you with a request for your help and advice.

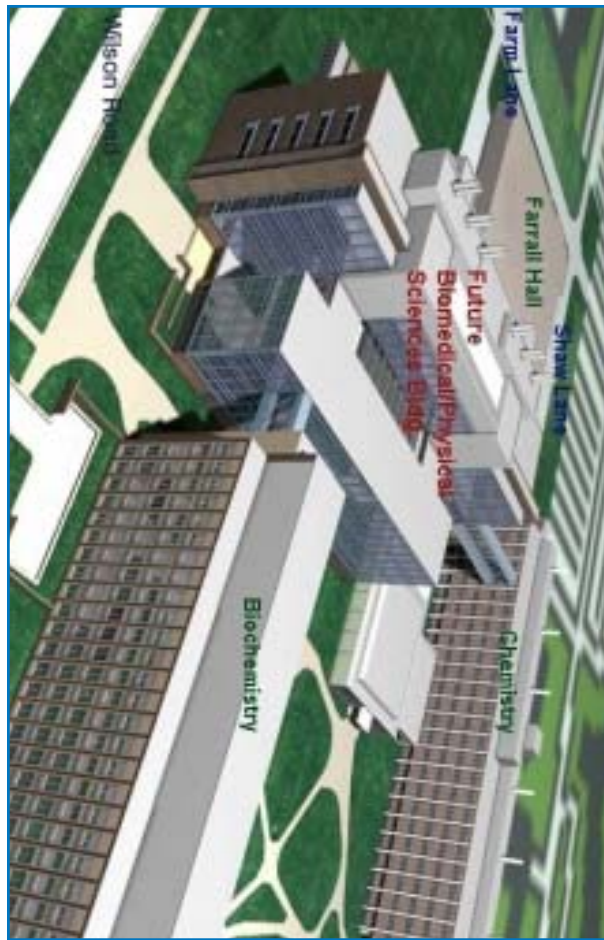
The last couple of years have delivered some sadness to us. In February of 1997 we were shocked when Professor Carl Foiles collapsed while playing

## A Letter from the Chair

It is my pleasure to invite you to the first in what we intend to be a regular series of newsletters produced for alumni and friends of the Department of Physics and Astronomy. My name is Chip Brock and I've been chairperson of the Department for a bit more than five years. As you'll learn over the next year or so, we've embarked on a number of exciting projects which will continue to increase the quality and visibility of our research efforts and significantly enhance the educational experiences which we offer to our students. We have not done an acceptable job of keeping our extended family up to date and I hope that you'll appreciate our new efforts.

For those of you who have not been in touch with us for a while, we've grown into a large physics and astronomy department with 59 full time faculty, still concentrated into four "interest groups." We are an active department: 89% of the faculty are supported by regular federal research grants which now amount to approximately \$13M per year, including \$9M from the NSF for the National Superconducting Cyclotron Laboratory. Support for our faculty comes from NSF, DOE, NIH, and various agencies of the DOD. 97% of the faculty published results of their research in peer-reviewed journals last year.

All groups are involved in major initiatives, and we'll touch on them in coming issues. Briefly: the nuclear physics group has begun a major upgrade of their unique facility in order to evolve into the premier source of high-intensity radioactive beams in the world. The competition for this upgrade was fierce and was won as a major construction project of the NSF due to the reputation and skill of the nuclear group as well as the imagination of the central MSU administration. The high energy physics group is deeply involved in both the leadership and the details of the upgrades of the two major detectors at Fermilab which are in pursuit of the top quark and the Higgs Boson. All 7 of the high energy physics faculty are similarly involved in the design and construction of the Atlas detector at the Large Hadron Collider at CERN. The condensed matter physics group has recently been renewed for another five year period in their successful \$12M Materials Research, Science and



On February 10, 1999, ground was broken for a new science building which will house the Departments of Physics and Astronomy, Physiology, and Microbiology. Officially known as the Biomedical and Physical Sciences Research Center, the building plans were developed over the last three years with input from the faculties of all three departments. The final design consists of a six-storey research tower, a four-storey office tower, and a one storey shop and lab annex connected on the ground floor by an atrium.



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tennis and subsequently did not recover from a massive heart attack. Then, just last month, we were saddened when Jerry Cowen's heroic yearlong battle with cancer took his life in a swift decline.



Both faculty will be remembered with fondness for their commitment to their department and their superior work as undergraduate teachers. [As we were completing the preparation of this Newsletter we learned the sad news that another longtime faculty member, Harvey Edwards, passed away on April 14. Professor Edwards came to MSU in the middle 50's after completing his PhD at the University of Michigan.]

We hope to hear from you. Jules Kovacs is attempting to find as many of you and your classmates as he can. If you have any knowledge of the whereabouts of your friends, we'd appreciate hearing from you. We plan to construct a chat area in our web site specifically for you to encourage your assistance as we try to establish the whereabouts of more of our alumni. Visit our cyber home at <http://www.pa.msu.edu> in order to catch up and stay informed as we pursue our future programs. You'll also hopefully find it as a means of reestablishing contact with your former colleagues. We'll be in touch with you again in the fall as we introduce our new classes to you. Please feel free to drop any of us a note or email message!

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## The New Building

Wayne Repko

The new Biomedical and Physical Sciences Research Center will be located just west of the Biochemistry Building on a site extending north from Wilson Road toward the Chemistry Building. It will be connected above ground to both buildings by enclosed overhead walkways and at the basement level. Construction costs are estimated at \$92 million. The Physics-Astronomy research space will be located in the basement, which will contain 21 condensed matter physics research laboratories, including a large clean room facility, and on the first floor, which will house

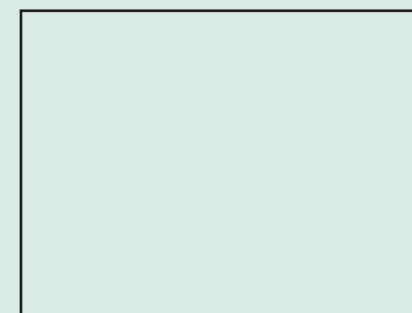
## NSCL Cyclotron Upgrade: The Coupled Cyclotron Project

Orilla McHarris

The NSCL is now in the process of an upgrade which will dramatically increase its capability by coupling the two existing superconducting cyclotrons (K500 and K1200) and by replacing the existing fragment separator (A1200) with one of increased capacity (A1900). The coupling of the cyclotrons will provide dramatic increases in the primary beam intensity, as well as increasing the energy of heavy ions, permitting a wide variety of experimental programs to be undertaken which are presently not feasible. The upgraded facility will provide a unique resource to the worldwide nuclear science community by filling a need for both stable and radioactive ion beams in an interesting and nearly unique energy domain. The high energies (90 MeV/nucleon for uranium) are an excellent match to the needs for studies of heated, compressed nuclear matter. The complementary aspects of the high intensity and low emittance for lighter ions are an excellent match to the needs of the growing radioactive ion beam field, as they provide very intense, good-quality secondary beams produced in fragmentation at a production target. The K500 cyclotron was completed in 1982 as the world's first superconducting cyclotron, and as such was prototypical. The K500 had known reliability problems, undesirable magnetic field harmonics, and a relatively poor beam chamber vacuum. When the K1200 was later constructed, the lessons learned were applied, and the K1200 has significantly better attributes and a notable reliability of >90%. The K500 was first completely disassembled to make significant improvements to the cyclotron vacuum system. It was thereafter reassembled, and, guided by magnetic field maps, yoke steel modifications were made which reduced the undesirable field harmonics. The K500 rf system was replaced with one following the K1200 system design.

high energy physics and astrophysics labs and the mechanical and electronics shops. The teaching facilities will include three lecture rooms with capacities of about 300, 180 and 65 students. Entrances to these rooms will be located in the atrium area. In addition to the lecture rooms, there will be eight undergraduate teaching labs, two regular classrooms and a large space for undergraduate help sessions. The Physics-Astronomy library, enlarged to hold Chemistry and Biomedical collections, will be located on the atrium opposite the large lecture rooms. All current P-A departmental office space will be located in the new building; NSCL faculty will remain at the Cyclotron Lab.

A magnetic system will transport beam from the K500 to the K1200. Installation of a mechanism to position the thin carbon stripping foils and improvement of the robustness of the extraction septa are the primary K1200 upgrade activities. (The capability to operate the K1200 in stand-alone mode will be retained.) The foil mechanism inside the cyclotron has been designed and construction initiated. The design of a loading system, which will allow foil replacement without interrupting the cyclotron vacuum, is in progress. A program to improve the K1200 extraction system was begun about two years ago and is planned to continue until the coupled cyclotron commissioning in the year 2001.



The three quadrupoles of one triplet being aligned on a surface plate.

A major element of the upgrade is a new fragment separator with an increased rigidity and greater collection efficiency. The A1900 will use 24 quadrupoles configured in eight triplet packages, and four 45° dipoles in a reverse bend geometry

so that incoming and outgoing beams are coaxial.

The A1900 magnets are energized by superconducting coils. Beginning in mid 1999, the K1200-supported experimental nuclear physics program will be stopped for a period of approximately 18 months to reconfigure the facility and install new equipment. A six months commissioning period is planned in 2001 with project completion scheduled during that year. The coupled cyclotron project is jointly funded by Michigan State University and the National Science Foundation. □

The Department office will be located on the fourth floor of the office tower, with faculty offices on the third and fourth floors. The Undergraduate office will be on the first floor near the building's main entrance. There will also be an Astronomy observing and control room in the atrium, where real time observing at various remote telescopes can be analyzed.

The anticipated completion date for the project is January 2002. A virtual reality video has been prepared and is located off the department home page. A real-time camera is recording construction and can be viewed at <http://theo08.nsl1.msu.edu/ConCam/hilites.htm> □

## Astronomy: SOAR

Horace Smith

The SOAR telescope is closer to reality after groundbreaking and the start of site preparation in Chile. The innovative new telescope is being built upon Cerro Pachon, a mountaintop not far from the existing Cerro Tololo Interamerican Observatory. The SOAR telescope, which will have an objective mirror four meters in diameter, is a collaboration among the National Optical Astronomy Observatories, the University of North Carolina, the country of Brazil, and Michigan State University. Gene Capriotti, Susan Simkin, and Vice-President for Research and Graduate Studies Robert Huggett represented MSU at the groundbreaking.



May 1998 Stonelaying

Cerro Pachon is located near the southern edge of Chile's Atacama desert. Skies there will not only be frequently clear, but the astronomical "seeing" (the sharpness of the star images) is also expected to be very good. The SOAR telescope is being designed to exacting mechanical and optical tolerances so as to be able to take full advantage of this excellent seeing and will be nearly diffraction-limited in the near infrared frequencies.

The Chilean location has other advantages as well. Whereas the astronomically active center of the Milky Way Galaxy barely rises far above the southern horizon as seen from Michigan, for the SOAR telescope it will pass spectacularly overhead. Moreover, the Large and Small Magellanic Clouds, satellite galaxies of the Milky Way, can be well observed from Chile, but never rise above the horizon in Michigan.

The SOAR telescope will provide MSU astronomers with access to a world class astronomical instrument. Data links from Chile to Michigan will make the telescope accessible to Michigan students on and off the MSU campus, who will not need to travel to Chile to make use of the telescope. The Physics and Astronomy Department is now beating the bushes for donations to help raise MSU's six million dollar share of the cost of building the SOAR telescope. Roughly \$2.1M has been raised to date. □