New Building
Nearly Complete

Wayne Repko

When seen from the outside, the new Biomedical and Physical Sciences (BPS) building looks ready for occupancy. The condition of the building’s interior, however, ranges from very nearly completed office and laboratory space on the upper floors to a noisy, dusty construction site on the main floor. Much of the main floor is devoted to physics teaching and research space, and at this stage of construction the walls for the various rooms are in place, large air handling ducts have been installed and the installation of the electrical service is progressing. The scheduled completion date of January, 2002 looks firm.

With the building completion only six months away, plans for the move are becoming serious. This will be a rather elaborate process since three departments, Microbiology, Physiology, and Physics-Astronomy, and the Chemistry and Physics libraries are moving into BPS. With luck, the move will be completed in the first half of 2002, and the first classes will be taught in BPS in the fall of 2002.
Dear Friends of the Department of Physics and Astronomy,

After seven years of dedicated and very successful service to the Department in the role of chairperson, Prof. Brock has decided to return full-time to the life of a researcher and teacher. His tenure as chairperson has seen marked improvements in our national rankings - we are currently number #10 in citation impact and #8 in federal funding of all physics departments in the country - and witnessed the start of very important construction projects, the coupled cyclotron upgrade, the SOAR telescope, and our new biomedical and physical science building. I am very fortunate to be able to take over the duties of chairperson from Prof. Brock. He will be a tough act to follow, but I am willing to try.

On July 27, we celebrated the inauguration of the new coupled cyclotron facility of the NSCL. This $20 Million upgrade will ensure that our nuclear physics group, currently ranked #2 in the country only behind MIT, will continue to be a leader in the international nuclear physics community. Among the speakers at the inauguration was Michigan Governor John Engler who pointed out that our research in the physical sciences was crucial for the future of the state of Michigan.

Our new science building will become our home starting in January and is making very rapid progress. In particular the research facilities for condensed matter physics, housed in the basement, will be competitive at the highest level. Many private donations, some of them very large, continue to ensure that we will be able to afford state-of-the-art research equipment, as well as to provide the highest quality teaching facilities for our students.

The construction of the SOAR telescope is making great progress, the undergraduate physics and astronomy major enrollments are rising, our teaching programs continue to earn national awards and large research grants, and the Department has just received its first privately endowed chair, the Jerry Cowen Chair of Experimental Physics. It sure is a great time to work and study in our department, and we hope that the content, as well as the new format, of this newsletter conveys this message to you and lets you share in the excitement.

Best wishes

Wolfgang Bauer

Chair, Department of Physics and Astronomy

A Letter from the Chair

Dear Friends,

The Charles J. Stroscio Foundation of Midland has given Michigan State University a grant of $230,000 to be used toward the new Biomedical and Physical Sciences Facility currently under construction on campus. The grant will specifically fund the Collaborative Teaching Laboratory in that part of the facility that will be utilized by the Department of Physics and Astronomy. Such a laboratory gives the department an opportunity to teach in a setting that best allows students to interact and develop their science skills.

“In addition to being the first lab of its kind on MSU’s campus, it will provide the unique venue that the practice of several years of experimentation in the department, clearly reinforces the mathematical and physical reasoning needed to firmly grasp the concepts of physics.

“Physics faculty at MSU have been learning over a long period of time the benefits of teaching in a collaborative atmosphere,” said Wolfgang Bauer, Chair of the Physics and Astronomy Department. “The new facility will enable us to build on our strengths and enhance our national leadership position in this field as well as enable us to teach our students more effectively.”

“The Stroscio Foundation has been a generous supporter of Michigan State University in the past, and this gift is further evidence of their commitment to supporting important educational opportunities,” said MSU President Peter McPherson. “We’re glad to count the Foundation among our most significant supporters of the new science facility.

The new Biomedical and Physical Sciences facility is a seven story, 350,000 square foot building located at the corner of Wilson Road and Farm Lane on MSU’s campus. It will connect with the biochemistry and chemistry buildings to create the largest research complex on campus and will provide much needed space for several colleges and departments across campus. Of the total $93 million cost for the facility, MSU is responsible for raising $13.3 million from private sources. The Stroscio Foundation gift brings MSU’s efforts to over $11 million to date.

The Foundation was established in 1957 by the late Charles J. Stroscio, one of the principal owners of Dow Chemical Company, to assist and benefit political subdivisions of the State of Michigan, and religious, charitable, benevolent, scientific and educational organizations.
A few microseconds after the big bang, the universe existed as a soup of quarks and gluons. These quarks and gluons were not confined in nucleons as we find them today but instead formed a plasma of nearly massless quarks and gluons. Using the Relativistic Heavy Ion Collider (RHIC) at Brookhaven National Laboratory on Long Island, New York, nuclear physicists are attempting to recreate this state of matter (on a small scale, of course!) by colliding two beams of gold nuclei each with kinetic energies of 100 GeV/nucleon. This energy is thought to be high enough to create an extended system of deconfined quarks and gluons. To detect the quark gluon plasma, nuclear physicists have created four specialized detection systems to measure the expected 10,000 particles per collision: STAR and PHENIX, PHOBOS and BRAHMS.

The STAR (Solonoidal Tracker at RHIC) detector consists of a large room temperature solenoid magnet, the world’s largest time projection chamber (TPC), a silicon vertex tracker (SVT), two forward TPCs (FTPCs), a central trigger barrel/time-of-flight array, a ring-imaging cerenkov hodoscope (RICH), and an electromagnetic calorimeter (EMC).

Last summer RHIC began its first physics run with the first event being recorded by STAR June 12, 2000. The main part of the run was carried out with two gold beams of 65 GeV/nucleon giving a center of mass energy = 130 GeV. A typical event observed by STAR is shown below as registered by the TPC. This view is looking down the beam axis at the TPC. This event is a central collision with about 1,500 tracks registered. RHIC and STAR finished the first physics September, 2000 and will resume running early this summer and run through April, 2002. STAR has published its first physics results in Physical Review Letters (Phys. Rev. Lett. 86, 402 (2001)) and has several more in preparation. MSU is carrying out an analysis project to clock the time of hadronization in RHIC collisions using the recently proposed balance function: Gary Westfall is a member of the STAR Council and is the Convener for the Event-by-Event Physics Working Group in STAR. During the last run Gary Westfall served as Period Coordinator for the last two weeks of the run.

Windows And More Windows Of Opportunity: The SOAR Telescope

"Supremely and ideally perched high in the Chilean Andes and blessed with an atmospheric ambiance of dry and infrared air - so coveted by astronomers - the SOAR telescope offers a superb window not only to explore the mysteries of our own galaxy but that of galaxies beyond. We are invited to become interested spectators of scientific probes seeking to unravel the mysteries of the universe, some would say to carry us back virtually to the creation of the cosmos. These are endeavors of majestic proportions. Repercussions have not ceased from that gigantic bang 13 billion years ago which set the cosmos and all its constituent parts in motion, including the earth and its solar system. Some galaxies have already died, some new galaxies have been formed, and others are being formed. All are in a state of flux. Nature’s urge to expand, to explore, is spontaneous digital transmissions from Chile. Few research endeavors can match that of the SOAR telescope in the breadth of its audience appeal and participation, not only for scientists in physics and astronomy and their graduate students but the wider academic audience and even the general public.

In an especially created viewing room on campus, we can have a front row seat to the spectacular scientific probes of our truly eminent MSU scientists - thanks to the magic of spontaneous digital transmissions from Chile. Few research endeavors can match that of the SOAR telescope in the breadth of its audience appeal and participation, not only for scientists in physics and astronomy and their graduate students but the wider academic audience and even the general public.

I harbor the ardent belief that endeavors emanating from this telescope will contribute significantly to making life for us earthlings more meaningful, more exciting, more interesting and even more highly valued by raising our individual awareness as well as that of the general public of our status in a fascinating, moving and ever-changing universe.

SOAR is a multi-institutional enterprise (Chile, Brazil, University of North Carolina and Michigan State University) requiring joint financial funding. It is imperative that MSU not miss this opportunity to make a quantum advance in its astronomy studies."

Dr. Milton Muelder
East Lansing, Michigan

Meet Jack Baldwin

Jack Baldwin joined the Astronomy Group in January 2000. He spent most of the previous 20 years as a staff astronomer at Cerro Tololo Interamerican Observatory, a US national observatory located in Chile. While in Chile, Baldwin was heavily involved in the SOAR telescope project, and so was drawn to MSU by our partnership in this 4m telescope.

Baldwin’s research centers on the study of quasars. Quasars are extremely luminous events that occurred in the centers of many galaxies roughly 12 billion years ago, at the time in which the galaxies we know today were just forming. These objects can be seen out to great distances, which means that the travel time for the light to arrive from them is a large fraction of the total 14 billion year age of the universe. So astronomers get to see back into time and study the evolution of galaxies and quasars. A typical quasar occupies a volume only about the size of our solar system, but from that small region generates an outward energy of up to 100 times greater than the combined energy output of all 100 billion stars in the galaxy. The generally accepted model is that this is the release of gravitational potential energy from surrounding gas falling onto an accretion disk around a massive black hole. The gas around black holes produces strong emission lines that Baldwin is studying in order to learn the chemical composition of the gas and about the early stages of the buildup of elements.

Background: Central collision of two gold nuclei at 130 GeV recorded in the STAR detector. The color of the track represents energy loss of the particle with warmer colors signifying higher energy loss.

Drawing of the Solenoidal Tracker at RHIC (STAR)

MSU nuclear physicist Gary Westfall and his group are collaborating in the STAR experiment. MSU is responsible for the construction of the optical fibers for the barrel EMC and the endcap EMC. The barrel EMC consists of 120 modules each containing 40 towers each with 21 layers of scintillator and lead. The endcap EMC consists of an annular detector with 720 towers each with 24 layers of scintillator and lead. Both the barrel and endcap EMC’s have shower maximum detectors embedded at a depth of five radiation lengths to provide high spatial resolution and hadronic/electromagnetic separation. Completion date for the calorimeters is early 2004.

The SOAR (SOuthern Astrophysical Research) consortium - in which Michigan State University is a key partner - will play a major role in the next generation of astronomy research in large part due to the development of a state-of-the-art telescope to be located in the mountains of Chile. Few people understand the benefits the telescope will provide quite like Dr. Milton Muelder, a history professor and vice president emeritus who has enriched the MSU community for over sixty-five years as a teacher, administrator and benefactor. He believes in the value of SOAR so much that he recently finalized an irrevocable $305,000 estate gift in support of the telescope. During a presentation to University Development, Dr. Muelder eloquently and movingly summed up why he thought that a knowledge of astronomy was an integral part even of a liberal arts education.

University Development asked Dr. Muelder to express in words the importance of support for the project, and he graciously supplied the following as a contribution to their Development Newsletter: (see inset)

For more information on supporting the SOAR telescope, contact Suzanne Hitman, Director of Development for the College of Natural Science, at (517) 353-9855.

Dr. Milton Muelder
Gives over $300,000 to the SOAR Telescope
The SOAR 4.2 meter telescope, currently under construction on Cerro Pachon, a 9,000-foot mountaintop in the foothills of the Chilean Andes, will be one of the most sophisticated instruments of astronomical discovery in the southern hemisphere. With the new technology of its adaptive optics, SOAR (Southern Astrophysical Research) will produce sharper images than any other 4-meter telescope and will compete favorably with new 8-meter telescopes that are also coming on-line. This will enable MSU astronomers, both faculty and students, to work in the forefront of studying the nature of the universe at the time the galaxies were forming and examining the early history of our own galaxy. Although it is located half a world away from the East Lansing campus, real-time operation of SOAR will be possible from the Remote Observing Center being constructed in the Biomedical and Physical Sciences building, the new home of the Physics & Astronomy Department. The Center, adjacent to the building’s atrium, will offer a window for past, present, and future Spartans (as well as the general public) to view firsthand the flow of data from SOAR, as well as participate in the excitement of discovery with MSU astronomers.

Current Status of the SOAR Project
The Department of Physics & Astronomy entered the SOAR consortium, which includes Brazil, Chile, the National Optical Astronomy Observatories, and the University of North Carolina at Chapel Hill, four years ago with the unanimous and enthusiastic support of the department faculty, the College of Natural Science, and the University. Astronomers at MSU have actively participated in the design and have reviewed not only the telescope itself, but also the instrumentation and control software that will make SOAR such a special tool for astronomical discovery. Final design reviews were completed in mid-1999. The team recommended construction of the Edwin Loh-designed instrument with only a few technical and budgetary modifications. In the infrared, astronomers can penetrate the gas and dust that shrouds some of the most interesting unexplored regions of our galaxy and of objects over half of the distance to the “edge” of the observable universe.

Each of MSU’s partners are also on schedule with their instrument projects. SOAR is unique in that a full set of instruments with a wide range of capabilities will be available during the early years of its operation.

SOAR Project Financial Summary
MSU’s financial commitment to the $28 million construction cost of SOAR is $6 million. Already, $2 million has been allocated from internal University resources. The task before us is raising the remaining $4 million of this commitment. A great deal of progress has already been made these past two years. From the generous donations of alumni and friends of CNS, we have raised more than $1.5 million towards the $4 million goal.

The Future
Astronomers refer to the date when a new telescope opens its eye on the universe for the very first time as “first light.” SOAR construction is now on target to achieve first light in October 2002— only a short time away! We are now making a new appeal in hopes of finishing the fund-raising effort in time for first light. As SOAR opens MSU’s window on the universe, we hope that you will participate in one of the greatest adventures in the history of Michigan State University.

Design of the Spartan Infrared Camera
MSU astronomers have completed designs for the construction of the Spartan Infrared Camera, a device that makes use of newly available large-format detectors that are sensitive to light in the near infrared portion of the spectrum. A team of experts from the National Optical Astronomy Observatories and other institutions participated in a critical design review of the Spartan camera at the MSU campus in May. The team recommended construction of the Edwin Loh-designed instrument with only a few technical and budgetary modifications. In the infrared, astronomers can penetrate the gas and dust that shrouds some of the most interesting unexplored regions of our galaxy and of objects over half of the distance to the “edge” of the observable universe.

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A charge accumulation imaging (CAI) microscope designed and constructed in Michigan State University is pictured at the left. CAI was developed by Stuart during his postdoc, together with his colleagues at MIT. It is an incredibly sensitive cryogenic probe of charging within conductors and semiconductor systems. Essentially, as a result of an applied excitation voltage, charge runs in and out of a sample. The technique measures the image charge capacitively induced on a sharp tip positioned somewhere near the surface. This signal represents a measure of the local mobile charge within the sample by the apex of the tip. The beauty of the measurement is that the conducting layer can be buried 10’s of nanometers below an insulating surface - yet still yield a resolvable signal on the tip. The microscope pictured was designed by graduate student Sergei Urazhdin. Our machine shop staff made the hardware, whereas the sensor electronics and scanning assembly was constructed (and reconstructed) by Sergei, postdoc Illari Maizulu, and graduate student Subhashish Chakraborty.

The data pictured here are from an experiment that locally resolves the quantum structure of two-dimensional semiconductor systems. In this case, the tip's position was fixed while monitoring the signal as a function of applied magnetic field. The dips arise as a result of the 2D layer becoming incompressible (insulating). They are related to their filling factor ‘ν’ which represents the number of filled quantum levels. In this way, Stuart’s group can locally probe physics intimately connected to the quantum Hall effect. Indeed, these measurements are the first of their kind, locally probing a buried two-electron system.

Meet Stuart Tessmer...
Stuart received his Ph.D. in Physics from the University of Illinois at Urbana-Champaign in 1995. He came to Michigan State in 1998; following 2.5 years of postdoctoral research at MIT. His work is focused on applying novel scanning microscopy techniques to probe the behavior of electrons in semiconductors and superconductors. From a technological point of view, these techniques can be used to map-out electronic interactions with defects and interfaces. In cases where the electrons are confined to small dimensions, it is possible to probe fundamental questions such as the nature of electron-electron interactions.

Randolph L. Cowen
MSU graduate Randolph L. Cowen of New York has donated $1.5 million to the Department of Physics and Astronomy to create the Jerry Cowen Endowed Chair in Experimental Physics. It is named in memory of Randy’s father, to honor his life and physics career at Michigan State University. In 1955, with the support of his wife Elaine, of Okemos, Michigan, Jerry, pictured below, began teaching in MSU’s Physics department where he had earned his Ph.D. He excelled in both materials science research and teaching, particularly at the undergraduate level - something he continued to do until weeks before his death in January 1999. His research spanned five decades with many international collaborations. “His passion and commitment to his research became an inspiration for all of the members of our family to try to have an impact in a field that we love,” explained Randy.

“My father dedicated his life to research in the field of solid state physics. He was always looking for new ways and materials to look at. I want my father’s legacy to be a part of the best research efforts in the country in the field of solid state physics so that cutting-edge research can go on,” Randy continued. “But also to draw a new generation of physics graduate students like my father to the university.”

Randy shared that he did not fully appreciate his father’s teaching strengths until he attended MSU as an undergraduate. “Some of my friends who took his courses have started to describe my father’s enthusiasm in lecturing to large roomfuls of students,” he said. “They took away not only a thorough grasp of the material that he taught, but also a vibrant image of his enthusiasm as he wrote across the chalkboard.” Randy, who received his Bachelor of Arts degree in history with a minor in Math from MSU in 1974, is Co-Chief Operating Officer of the Technology Division and a Managing Director for Goldman Sachs, a global investment banking and securities firm headquartered in New York. He and his wife, Phyllis Green, have two children, Sarah and Matthew.
The stars that Beers seeks are deficient in their abundances of “metals” (to an astronomer, any species heavier than helium) by factors of 100 to 10,000 times less than the Sun. Because the Sun formed rather recently in Galactic history, the gas out of which it was formed had been polluted by many previous generations of the element-producing stars. By contrast, at the time that has passed since that element was formed in the early Galaxy, the presence of the radioactive element uranium, the first such detection of this element outside of the Solar System. The discovery has sparked a flurry of activity by researchers around the world to exploit the measured abundance of uranium in this star as a “cosmo-chromometer,” in order to set limits on the time that has passed since that element was formed in the early Galaxy.

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On July 27, the NSCL hosted a gathering of over 400 guests to celebrate the completion of its new state-of-the-art Coupled Cyclotron Facility (CCF), a $20 Million construction project, which was delivered ahead of schedule and on budget. Among the speakers was Governor John Engler, who pointed out the importance of research and scientific research for the Michigan economy. The new CCF will ensure the continued international leadership of our nuclear physics group for at least the next 5-10 years. With an eye on the future further down the road, we are competing to build the Rare Isotope Accelerator, a next generation facility that could cost more than $0.5 billion. Governor Engler expressed his strong support for this plan.

Visit the NSCL web site at http://www.nscl.msu.edu

Principle of a Penning ion trap, left figure, and ion motion, right figure. A strong magnetic field B (several Tesla) and a weak electric field created by voltages applied to three electrodes provides forces that allow a particle with charge q to be confined in space. From the observation of the characteristic motion of the trapped ion (bottom) the cyclotron frequency $f = qB/m$ of the ion can be determined with high precision and its mass $m$ be determined.

After finishing a four year term as the leader of the ISOLDE physics group at the European Research Laboratory for Nuclear Physics, Georg Bol became professor at the Ludwig Maximilians University in Munich. He stayed there only six months and accepted an offer to come to MSU and NSCL, where he arrived last summer (June 1). His wife, Magelone, and sons Anton and Viktor have joined him in (June 1). His wife, Magelone, and sons Anton and Viktor have joined him in Michigan Governor John Engler speaking at the inauguration ceremony of the CCF, Friday July 27th at the Wharton Center Pasant Theater.

Physics. He was a main player in developing Penning trap mass spectroscopy for its application to rare isotope beams. Atomic mass measurements provide insight into how strongly the nucleons in a nucleus are bound together. Nuclear structure effects like shell closures, pairing and nuclear deformation can be observed and data provided that are relevant for nuclear astrophysics and for tests of the fundamental interactions. The ISOLTRAP experiment at CERN, which has been led by Bollen for many years, is today the most successful enterprise of this kind. It has provided substantial information on nuclear binding energies at various regions of the nuclear chart and demonstrated the power of the approach. Bollen has initiated and conducted several projects in which ion traps and trapping techniques are used for the manipulation and improvement of rare isotope beams, for example in the context of their post-acceleration.

Bollen’s specialty is the trapping of ions in devices called ion traps and to apply this atomic physics technique to nuclear physics. He was a main player in developing Penning trap mass spectrometry for its application to rare isotope beams. Atomic mass measurements provide insight into how strongly the nucleons in a nucleus are bound together. Nuclear structure effects like shell closures, pairing and nuclear deformation can be observed and data provided that are relevant for nuclear astrophysics and for tests of the fundamental interactions. The ISOLTRAP experiment at CERN, which has been led by Bollen for many years, is today the most successful enterprise of this kind. It has provided substantial information on nuclear binding energies at various regions of the nuclear chart and demonstrated the power of the approach. Bollen has initiated and conducted several projects in which ion traps and trapping techniques are used for the manipulation and improvement of rare isotope beams, for example in the context of their post-acceleration.

Bollen’s research plans at the NSCL focus mainly on precision experiments on rare isotope beams at low-energy. Such beams will be available in the near future and will be produced by stopping the existing fast beams in a gas cell and by re-forming them into a slow ion beam. These new beams will add an important new facet to the already rich experimental program at the NSCL. The so-called LEBIT (Low-energy beam and Ion trap) project is still in its design and construction phase but when completed it will allow techniques like Penning trap mass spectrometry, laser spectroscopy, or precision measurements of trapped ions and atoms to be applied to the beams produced at the NSCL. Presently, Bollen and his group of a post-doc (Stefan Schwarz) and two others from Corning, Inc. (the so-called LEBIT (Low-energy beam and Ion trap) project is still in its design and construction phase but when completed it will allow techniques like Penning trap mass spectrometry, laser spectroscopy, or precision measurements of trapped ions and atoms to be applied to the beams produced at the NSCL. Presently, Bollen and his group of a post-doc (Stefan Schwarz) and two others from Corning, Inc. will have access to the most exotic isotopes with half-lives as short as a few milliseconds. Bollen and his group of a post-doc (Stefan Schwarz) and two others from Corning, Inc. will have access to the most exotic isotopes with half-lives as short as a few milliseconds.