Department of Physics and Astronomy Alumni Newsletter

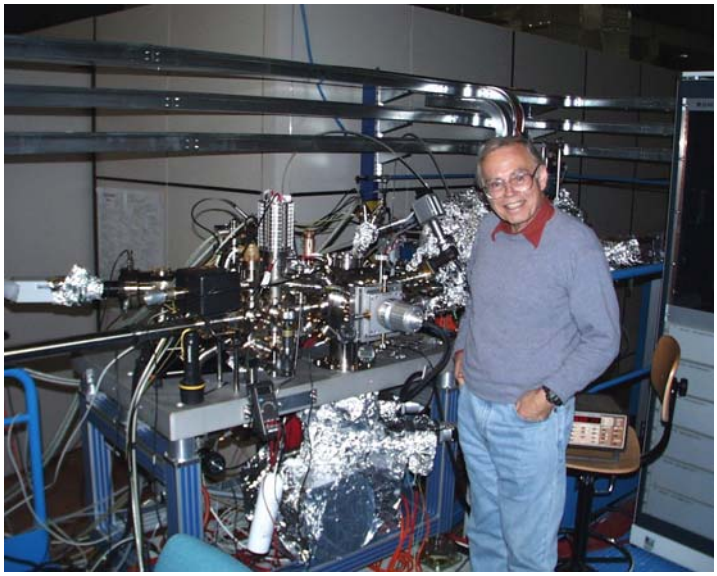
Winter 2005

Department of Physics and Astronomy, Arizona State University, Tempe, AZ 85287-1504 --- phy.asu.edu

Ernst Bauer thrice honored for outstanding work in physics

Distinguished research professor Ernst Bauer was honored three times in the period from October 2003 to November 2004.

In October 2004 Bauer was awarded the very prestigious **Davisson-Germer prize of the American Physical Society for 2005**. This prize was established to recognize and encourage outstanding work in atomic physics or surface physics. Prof. Bauer was recognized **"*For contributions to the science of thin-film nucleation and growth, and for the invention of Low Energy Electron Microscope".*** The prize will be presented at the APS March 2005 meeting at a special Ceremonial Session.



(Ernst Bauer with the SPELEEM instrument at the synchrotron radiation source ELETTRA in Trieste, Italy in February 2002.)

Bauer's career has included pioneering contributions to most aspects of surface science. His classic early work (1958) on the classification of crystal growth modes, which he called Volmer-Weber, Stranski-Krastanov and Frank-van der Merwe mechanisms provided the theoretical background used to understand epitaxy worldwide to this day.

The invention in 1962 of the Low Energy Electron Microscope (LEEM) was stimulated by a scientific dispute with Lester Germer about the interpretation of the low energy electron diffraction (LEED) patterns. Ernst Bauer realized that the only way to resolve this problem is to use the diffracted electrons for imaging. He took this challenge and the first LEEM was "born" in 1964 but it took about 20 years to bring this instrument to fruition (1985). LEEM is using slow electrons, which makes it very surface sensitive. The high signal intensities available from this instrument allows dynamic imaging of surface processes in real time. By the eighties LEEM had matured and began producing remarkable movies of semiconductor and metal systems, which contributed greatly to the understanding of atomic processes on surfaces.

In the late eighties/early nineties he extended the LEEM technique in two directions by developing two new surface microscopy methods: Spin-Polarized Low Energy Electron Microscopy (SPLEEM) and Spectroscopic Photo Emission and Low Energy Electron Microscopy (SPELEEM).

In 1996 the SPELEEM instrument built in Bauer's research group was transferred to the synchrotron radiation facility ELETTRA in Trieste (Italy) and started in the following years a new era in X-ray Photo Emission Electron Microscopy (XPEEM) by combining imaging with diffraction and spectroscopy, both in

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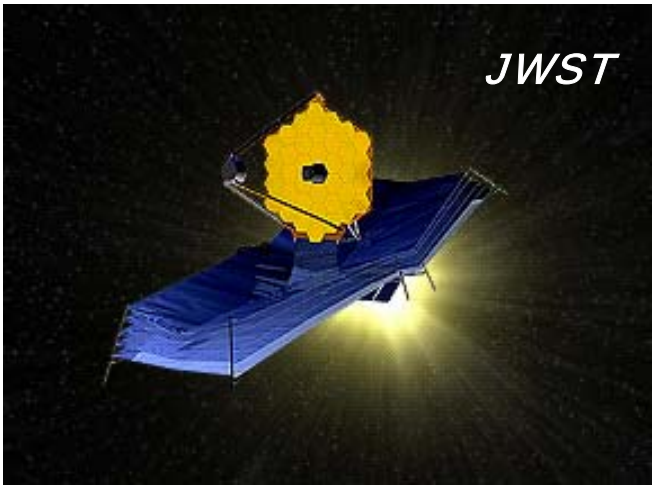
In This Issue

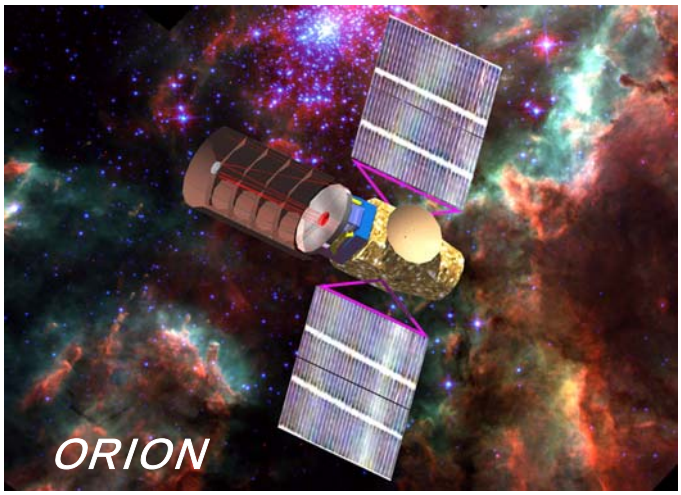
ASU astronomers develop new space missions

ASU astronomers using the Hubble Space Telescope (HST) have had a remarkably productive and exciting era using that orbiting spacecraft to unlock many of the secrets related to how stars, galaxies, and planets have formed. However, with the telescope well into its second decade and limited options available for sustaining HST since the Columbia disaster, ASU astronomers and others are looking at a new set of missions to continue observations beyond Hubble.

Prof. **Rogier Windhorst** is one of six interdisciplinary scientists selected for the Science Working Group planning NASA's next generation space telescope, the **James Webb Space Telescope** (JWST). JWST will be a large-aperture (6.5 m) optical and infrared telescope designed to study the first stars and galaxies after the Big Bang, and to uncover the processes of star and planet formation in our galaxy. Unlike HST which carried out its work in low-earth orbit, the $1.6 billion JWST will orbit in the second Lagrange point beyond the Moon (L2). The telescope has an expected launch date in 2011 and a 5-10 year lifetime, and will carry three infrared instruments.



ASU astronomers are also developing a $170 million mission to study star and planet formation. Like JWST, the 1.2-m ultraviolet-visual observatory, named **ORION a**lso will orbit at L2. The project is lead by Prof. **Jon Morse**, Associate Research Professional **Paul Scowen** and Postdoctoral Research Associate **Matthew Beasley**. Profs. **Jeff Hester, Rogier Windhorst, Steve Desch,** and Assistant Research Scientist **Rolf Jansen**. are also members of the team. ORION's mission encompasses three phases. The initial phase will conduct the first high spatial resolution survey of visible star-forming environments in our "neighborhood," within 8,000 light-years of the Sun in order to understand how the local environment influences the way stars and planets form.



Following this local survey, the second phase will provide a similar survey of portions of nearby galaxies. The results from the local survey will allow the characterization of low-mass star forming environments in the Magellanic Clouds, study the spatial distribution of star forming environments and analyze stellar population photometry to trace star formation history. Finally, in the third phase, a representative sample of more distant galaxies will be used to characterize nearby star formation regions, mapping the distribution of star forming regions for galaxies out to 25 million light-years.

While these two spacecraft will look at various wavelengths of light, another probe being developed by ASU astronomers and colleagues will target "dark energy".

Over the past 15 years, astronomers have found evidence that the Universe has not been expanding at a constant rate, but was expanding more slowly in the past and is now accelerating. The impetus behind this acceleration has been dubbed dark energy.

The properties of dark energy are almost completely unknown at this time, and yet this mysterious force is responsible for over 70% of the energy density of the Universe! (By comparison, the normal matter that composes stars, planets, and people makes up a paltry ~5% of the energy density of the Universe, with the rest of the energy density residing in the elusive "dark matter", which scientists are still unable to explain after detecting its effects on galaxies several decades ago.)

The "Dark Energy Space Telescope" (**DESTINY**) is a mission concept to explore this dark energy. DESTINY is designed to observe a large sample of

Council of Scientific Presidents 2003 Educational Research Award for David Hestenes

At a ceremony in Washington, DC on November 23, 2003, Prof. Emeritus **David Hestenes** was given the Council of Scientific Society Presidents (CSSP) 2003 Educational Research Achievement Award for outstanding research that measurably improved student learning. Hestenes was selected after a deliberative process of more than two years.

The award citation reads "For his seminal research that developed pioneering programs to open new vistas of value in effective model curricula for the teaching of science, Extensive application of his concepts has significantly improved learning outcomes for a wide spectrum of students."

The CSSP, with an outreach to more than 1 million scientists and science educators, is a national center of science leadership development and science policy, and serves as the premier forum for open, substantive exchanges on emerging scientific issues. Its meetings are devoted to action planning for the future of research universities, biotechnology, economic competitiveness, environmental sustainability, ethical limits of research, educational research, cyberspace and other areas.

At the award ceremony, Hestenes challenged CSSP with a proposal for nationwide K-12 science/math education reform based on his long experience with physics education and the success of his program at ASU. "With more than a decade of NSF support, the Modeling Instruction Project has evolved from a program of summer workshops on physics pedagogy to a full-scale graduate program for professional development of teachers in all the sciences and mathematics," he noted.

"A successful exemplar institutionalized at Arizona State University proves that this mechanism is easy to implement, cost effective, and sure to work."

2003 Four Corners section meeting at ASU

The ASU Department of Physics and Astronomy hosted the annual Four Corners Section Meeting of the American Physical Society on October 24-25, 2003. This is a relatively new APS Section (~5 years old) formed to promote interaction and communication among physicists within Arizona, Colorado, New Mexico, and Utah. The meeting took place in the ASU Memorial Union. Financial support was provided by the ASU Department of Physics and Astronomy (DPA) and by the Graduate College. Outside support was contributed by Motorola and the Durel Corporation.

Over 200 physicists attended from over 15 different universities and labs in the Four Corners states and several other states as well. Among the participants were faculty, graduate students, undergraduate students from universities; researchers from national labs; officers from the APS and AAPT; and high school students. Invited talks were given by Keith Dienes (UA), Steven Elliott (LANL), **Jeff Hester** (ASU), Angelo Mascarenhas (NREL), Margaret Murnane (CU), **Timothy Newman** (ASU), Brian Saam (Utah), and **Michael Thorpe** (ASU). A plenary public talk was given by Prof. Venkatesh Narayanamurti, Dean of the College of Engineering and Applied Sciences at Harvard University. In addition to the plenary talk and the eight invited talks, there were a total of 79 contributed talks running in three parallel sessions.

The local conference committee consisted of Profs. **Bruce Doak** (Chair), **John Shumway, John Page, Per Aannestad, Rich Lebed,** and **Howard Voss**, in addition to graduate students **Marianne Stefanini**, **Daniel Martin**, and **Mike Grams** and undergraduate **Tom Skala.** Administrative affairs were handled by **Linda Scowen** of the DPA, along with other office staff who pitched in to help with everything from finding ball point pens to stuffing 200 separate envelopes.

Twelve awards of $100 each were given for the best student talks and posters. Seven went to graduate students, including ASU students **Candi Cook, Ramon Grima, Emily McDaniel,** and **Newton Ooi.** Four awards went to undergraduates: Carolee Blackham (BYU), Thomas Butler (BYU), Melinda Tonks (BYU) and Thomas Topel (CSU). Another award went to high school student Sarah Stokes (working with a group at BYU).

Gerard 't Hooft captivates a packed house as ASU hosts it's first *Distinguished Lecturer Series*

Gerard 't Hooft, Nobel Laureate and Professor of Theoretical Physics at the University of Utrect gave two standing room only lectures October 11th and 12th.

His talks were the first of Arizona State University Physics and Astronomy Department's newly developed *Distinguished Lecturer Series*. The *Distinguished Lecturer Series* give the public and academic communities the opportunity to learn about the latest research from speakers among the most celebrated and accomplished scientists in the fields of physics and astronomy today. 't Hooft clearly encompassed these traits, as he thouroghly captivated his audiences.

In his first, a general lecture entitled "The Universe inside the atom", 't Hooft discussed the beauty and wonder of the atomic nucleus in non-technical terms.

During his second lecture, a colloquium entitled "Black Holes and the Foundation of Quantum Mechanics", 't Hooft delivered a stunning presentation in which he theorized that in a black hole, an apparent conflict between Einstein's General Relativity and the laws of Quantum Mechanics becomes evident.

Gerard 't Hooft received his doctoral degree in physics in 1972 at University of Utrecht where he has been Professor of Physics since 1977. His primary research interests focus on gauge theories in elementary particle physics; quantum gravity and black holes; and fundamental aspects of quantum physics. He is the recipient of several prestigious awards including the 1999 Nobel Prize in Physics. He and his colleague Dr. Martinus Veltman are responsible for placing particle physics theory on a firmer mathematical foundation. For more information about Gerard 'tHooft and upcoming lectures please visit http://phy.asu.edu/

Bauer honored *(from page 1)*

XPEEM and LEEM. In 2000 a commercial version of the SPELEEM was installed at a beamline specifically built for it, the Nanospectroscopy beamline. It is presently the most sophisticated microscopic multi-method surface characterization instrument (see photo on page 1).

For this last development he was honored in November 2004 with the **2004 year Innovation Award on Synchrotron Radiation.** This award was established in 2001 by the BESSY Society in Berlin, Germany for an outstanding technical achievement or experimental method. Prof. Bauer was recognized for: "***Excellent contributions towards the development of the photoelectron emission microscope (PEEM) as energy -, space- and time resolved detection system of photoelectrons***".

Ernst Bauer has had intensive international scientific collaborations with several countries, including Japan for many years. In October 2003 he received the first **Award of the Japan Society for Promotion of Science's 141st Committee on Microbeam Analysis**. The award is in recognition of Bauer's ***"outstanding research on microbeam analysis and contributions to the JSPS 141 Committee."*** Bauer was also made an honorary member of JSPS.

Now at least 30 LEEM instruments are operating in many laboratories and synchrotron radiation facilities around the world. This is an important recognition for his efforts in the field of surface microscopy. Four international conferences have already been devoted entirely to LEEM/PEEM.

"My main activities and goals in the area of research were to build up further the reputation of ASU as the world's leading center in surface electron microscopy with slow electrons, thus broadening its international reputation in electron microscopy in general" Bauer said. He achieved his goal. ASU President Michael Crow wrote in his congratulation letter in November 2004: "This prize both appropriately acknowledges your life's work, and by association, enhances the reputation of our university. Such noteworthy distinctions are a critical part of creating a culture of high achievement within our *New American University*, and I thank you for representing ASU so honorably." Bauer's comment: "I would like also to thank ASU, CLAS and the Department of Physics and Astronomy for providing me the environment necessary for high quality research. Great achievements consist of many small achievements and many people contributed to them."

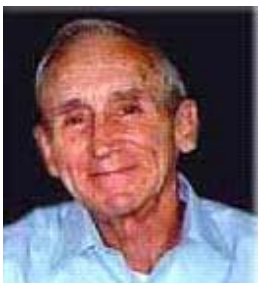
Department mourns losses of faculty, staff members

Professor Emeritus **John Cowley** passed away on May 18, 2004 in Tempe.

Cowley joined ASU in 1970 in its first endowed faculty position, the Galvin Professorship in Physics. He founded the electron microscopy facility, which under his leadership came to be recognized as the premier electron microscopy center in the world. He served as facility director from 1983 to 1990. Last October, the Center for High Resolution Electron Microscopy was renamed in his honor.

Cowley's scientific leadership had a highly significant impact on establishing ASU as a Research I University. In 1988, Cowley was in the first group of faculty bestowed with the title Regents' Professor, an honor reserved for a limited, small fraction of the faculty that have demonstrated exceptional scholarship and achievement. He officially retired from ASU in 1994, but continued to be highly active. He spent time in his campus office almost every day, including the day of his death. In January 2003, an international workshop was held at ASU to celebrate Cowley's 80th birthday and the 25th anniversary of the Center for High Resolution Electron Microscopy.

Cowley was an extraordinarily productive scientist, with a career spanning more than a half-century. His ideas and understanding of electron optics and diffraction phenomena provided inspiration and leadership to the entire field of electron microscopy. His book *Diffraction Physics* is the standard reference in the field. He received the highest awards of the International Union of Crystallography, the Electron Microscopy Society of America and the American Crystallographic Society, and was elected to Fellowship in the Australian Academy of Science, The Royal Society of London, and the American Physical Society.



Robert Fried, Observatory Manager of the ASU Braeside Observatory (ASUBO) for the Department of Physics and Astronomy died November 13, 2003 in the crash of his private plane. Bob and his wife Marian donated the land and facilities in Flagstaff for ASUBO to ASU in July 2000 (featured in the Winter 2000 newsletter).

Bob's enthusiasm for astronomy was infectious. As well as facilitating the transition of ASUBO to reliable, remote operation for use in introductory and advanced astronomy laboratories, he also worked with Flagstaff High School to provide opportunities for high school students. The legacy of his love for astronomy lives on in the hundreds of students who use ASUBO each semester.

Denise Jackson, Executive Assistant of the Department of Physics and Astronomy passed away June 15, 2004. Denise spent her entire 21-year career in the department, serving in many capacities prior to becoming the department's Executive Assistant in 1993. Denise's conscientious service to all those who worked or visited the department was always marked by her kindness and joy.

In Denise's memory, an annual award for outstanding staff performance in the department has been established (see "*From the Chair*" section).

Vatche Tutunjian, Lecturer, passed away August 21, 2003. A dedicated and conscientious instructor, he taught introductory physics courses for over 13 years. During that period, he taught several thousand students, and was nominated for the CLAS Distinguished Teaching Award in 1988.

Born in Lebanon, he received his Ph.D. in theoretical nuclear physics from Rutgers in 1984. He served as a visiting assistant professor at Stockton State College in 1984 before coming to ASU as a post-doctoral research associate. He was an assistant professor at the University of Indianapolis from 1986-87. He then served as a faculty associate and faculty research associate from 1988 until being appointed Lecturer in 2003.

New faculty members join department

Continuing with its five-year growth and development plan, the Department of Physics and Astronomy (DPA) will expand with two new faculty members who began in Fall 2004.

Carl Covatto joins DPA as a Lecturer in physics and astronomy. Covatto received a B. S. in physics from New Mexico Institute of Mining and Technology in 1993. His doctoral research at ASU was with Prof. Per Aannestad on the dynamics of circumstellar shells.

During his graduate study at ASU, he was awarded three semesters of support from the NASA Space Grant Consortium, a one-year Regents Academic Scholarship, and was twice awarded Teaching Assistant of the Year in DPA. He also served as an Adjunct Faculty member at Mesa Community College during that period.

Andrei V. Belitsky joins DPA as an Assistant Professor in subatomic theory. Andrei received his doctorate in theoretical physics in 1996 from the Bogoliubov Laboratory of Theoretical Physics at the Joint Institute for Nuclear Research in Dubna, Russia. His dissertation research used quantum chromodyanmics sum rules to investigate the structure of photons and hadrons.

Following his graduate study at JINR-Dubna, Belitsky received postdoctoral research appointments at the State University of New York – Stony Brook and at the University of Maryland in College Park before becoming a Research Assistant Scientist with the Theoretical Quarks, Hadrons, and Nuclei group at the University of Maryland.

His current research directions explore perturbative and non-perturbative phenomena in the field theory of strongly interacting particles using quantum chromodynamics. This work aims to unravel the dynamical structure of known hadrons, as well as investigating new forms of matter using a number of field theoretical approaches.

New space missions *(from page 2)*

of the Universe over billions of years to a few percent. This precision will allow scientists to test specific models for the expansion history of the Universe and will elucidate the characteristics of the dark energy. The dataset will also aid scientists in understanding the physics of supernova explosions.

NASA has awarded ASU, under the direction of Prof. **Jon Morse,** a grant to investigate details of the technical approach to making the required observations. The award is for a 2-year study of the observing strategy, technical implementation, technology roadmap, and cost of the DESTINY mission.

The study will also assess the contributions that ground-based observations can make in support of the DESTINY mission and to the understanding of dark energy. The NASA award is for ~$200,000 for a 2-year study.

37 students complete studies

Degrees were awarded to 37 physics and astronomy students during commencement ceremonies held August 2003, December 2003, May 2004, August 2004, and December 2004.

Degree recipients were:

Bachelor of Science:

Justice Bruursema, Joseph Cera, Colin Chaney, David Clarkson, Michael Cooper, Kevin Dixon, Andrew Getskow, Tyler Glembo, Jeremy Janusz, Aaron Jesse, Michael Kocher, Lance Levenson, Adam Mott, Efunwande Osoba, Cody Raskin, Justin Rogers, Scott Schafer, Jason Smit, Donovan Terry.

Master of Science:

James Corkins, Eric Dykeman, Theodore Vecchione

Master of Natural Science:

Brian Bingham, Hussein Fouad El Ebiary, Jayita Goswami, Kristen Guyser, Pamela Herriman, Michael Holland, Louise McConnell, Colleen Megowan, Richard Runyon.

Doctor of Philosophy:

Kevin Healy, Andrey Korytko, Wei Liang, Antonio Ramirez, Justin Shaw, Lingyun Shi

Spring 2005 Colloquia schedule

Exciting topics by internationally recognized speakers

January 27	Wick Haxton University of Washington	*Underground Science and the DUSEL Effort*
February 3	Maria Kilfoil McGill University	*Tomography of Sphere Packs*
February 10	Molly McCartney Arizona State University	*Electron Holographic Characterization of Nano-scale Electric and Magnetic Fields*
February 17	Ernst Bauer Arizona State University	*Slow but Powerful: Microscopy with Slow Electrons*
March 3	Mildred Dresselhaus* MIT	*Recent Advances in the Photophysics of Carbon Nanotubes*
March 10	David Stork Ricoh Innovations and Stanford University	*Did the Great Masters Cheat Using Optics?*
March 24	Paulo Freire Arecibo University	*Double Pulsars*
March 31	Denis Weaire Trinity College Dublin	*The Physics of Foam*
April 7	Alan Boss Carnegie Institution of Washington	*A Heretics Approach to Solar System Formation*
April 14	Christian Iliadis University of North Carolina	*Nuclear Astrophysics Experiments*
April 21	Salvatore Torquato Princeton University	*Optimal Particle Packings: Problems for the Ages*
April 28	Andrey Vilesov University of Southern California	*Helium Droplets*

*Distinguished Lecturer

Physical Science F-wing, Room 123
All talks begin at 4:00 PM
(Refreshments at 3:40 PM)

From the Chair

Having missed a few newsletters, we've gotten somewhat behind in providing you details of all that's been happening here. Change is part of the everyday routine here at ASU.

As you've seen in these pages, we've felt the loss of a number of colleagues this past year. Among the keenest losses felt was Executive Assistant Denise Jackson, a familiar friendly face for anyone who visited the department over the past 20 years. As one faculty member put it, she was the "Google" of the department, with an encyclopedic knowledge of the university and a watchful eye on everything happening here. Denise passed away in June 2004 from breast cancer, having spent her entire career in the Department of Physics and Astronomy. In her honor, an annual dinner and award has been established to honor staff members in the department. With an initial endowment provided by the faculty of DPA, the fund continues to receive financial gifts of remembrance for Denise from alumni and friends around the world. If you'd like to help honor and remember Denise by contributing to that fund, please send your contribution to Ms. Martha Ledy here in the department. If you have any remembrances you'd liked passed along to her family, we'd be happy to do that, as well.

Big organizational changes are afoot. Two new schools are being established at ASU: the School of Earth and Space Exploration and the School of Materials. With those changes (which likely will see some colleagues in DPA move to the new schools), our department is looking at recasting itself as an intentionally cross-disciplinary physics department for the 21st century. I hope to share more details of those plans with you in the next newsletter.

As always, your financial gifts to the department's Gifts and Awards Account make many things possible we'd otherwise be unable to do. We are grateful for those gifts and acknowledge our family of contributors at all the events those funds help sponsor. If you're not a financial contributor to the department, I hope you'll consider becoming one. Please contact Ms. Martha Ledy if you have any questions (by e-mail Martha.Ledy@asu.edu, mail to the department, or by phone at (480) 965-0587).

Finally, I'd like to acknowledge the skillful editing and production of the newsletter by Ms. Stephanie Alvey-Read, who now is serving as our newsletter editor. If you have any news or story ideas you'd like to share with her, please e-mail those to her at Stephanie.Read@asu.edu.

Please keep in touch and visit us when you can.

Sincerely yours,

Barry G. Ritchie
Professor and Chair

Department of Physics and Astronomy Staff

Main Office
Stephanie Alvey-Read
Cali Chavarria
Shawn Dubon
Lynne Kincaid

Business Office
Niki Deahl
Martha Ledy
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Richard Henne
Gary Jarrette
James Makar
Brian Nagy
Mark White

You can reach faculty and staff members via e-mail by using their name plus the domain asu.edu, e.g.:Barry.Ritchie@asu.edu

Department of Physics and Astronomy Faculty for the 2004-2005 Academic Year

Ricardo Alarcon
Ernst Bauer
Andrei Belitsky
Peter Bennett
David Burstein
Ralph Chamberlin
Joseph Comfort
Carl Covatto
Anne Cowley
Robert Culbertson
Steven Desch
Bruce Doak
John Dow
Jeff Drucker
Nicole Herbots
John "Jeff" Hester
Stuart Lindsay
Richard Lebed
Robert Marzke
Martha "Molly" McCartney
Jose Menendez
Jon Morse
Timothy Newman
Luanna Ortiz
John Page
Fernando Ponce
Peter Rez
Barry Ritchie
Otto Sankey
Kevin Schmidt
John Shumway
David Smith
John Spence
Sumner Starrfield
Michael Thorpe
Bill Tillery
Mike Treacy
Frank Tsen
Ignatius Tsong
John Venables
Rogier Windhorst

Arizona State University
Physics & Astronomy Department
P.O. Box 871504
Tempe, AZ 85287-1504