

# MOMENTUM

THE UNIVERSITY OF KANSAS DEPARTMENT OF PHYSICS AND ASTRONOMY

## Department welcomes visitors, congratulates award winners

One benefit of academic and research careers is the opportunity to travel to lovely places for work and collaboration.

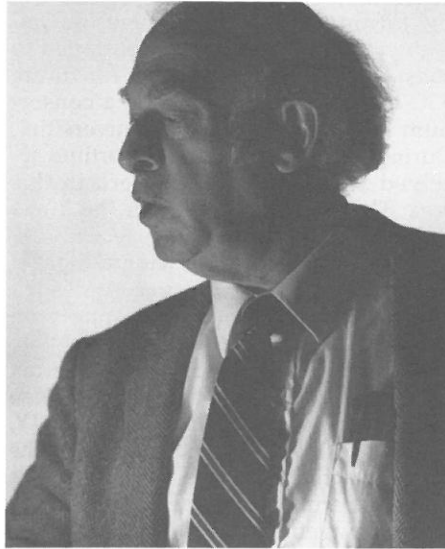
Professor Herman Munczek attended the Lepton-Photon Symposium this past July and the European Physical Society meeting in Geneva. Professor Douglas McKay spent two weeks conferring with colleagues at Ames Laboratory, while Professor Sergei Shandarin attended a workshop on galaxy formation in Aspen in June.

Another benefit is, of course, the pleasure of welcoming friends and colleagues for reciprocal visits to your home institutions.

Some of our shorter-term visitors in 1991 included Professor V.A. Miransky from the University of Western Ontario, J.C. Yun from FermiLab, Thomas Gehrels and Mihaly Horanyi of the Lunar and Planetary Lab of the University of Arizona, Terry Clark from NCAR-Boulder, Janet Luhmann from UCLA, Russell C. Schnell from CIRES at the University of Colorado, Robert Philips of Haystack Observatory, Charles Perry of the U.S. Geological Survey, and Anthony Tyson of AT&T Bell Laboratories.

We welcomed Professor Jerome Friedman to KU in November to deliver a public talk titled "Are We Really Made of Quarks?" Friedman, of the Massachusetts Institute of Technology, won the Nobel prize in 1990 for his pioneering investigations concerning deep inelastic scatterings of electrons on protons and bound neutrons, studies of essential importance for the development of the quark model in particle physics.

A number of visitors were able to stay for extended periods of time to collaborate with researchers in the cosmology group. These visitors included Lev Kofman from the Institute of Astrophysics in Estonia, Robert Scherrer from Ohio State University, Sergei Gurbatov of Gorky State University, Naoteru Gouda from the University of Kyoto, Eleonora Kotok of the Institute of Applied Mathematics in Moscow, Chang-Bom Park of the California Institute of Technology, and Guinevere Kauffmann, a



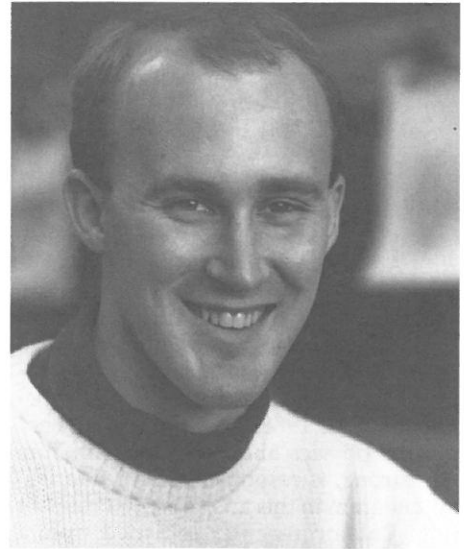
**Jerome Friedman, 1990 Nobel Prize recipient, spoke at KU in November.**

graduate student from Cambridge University, England.

Karoly Kecskemety from the Central Research Institute for Physics in Budapest, Hungary, was a visiting scientist in the department from February 1991 through June 1991, sponsored by T.E. Cravens. They collaborated on analyzing energetic ion data from the 1986 Soviet spacecraft encounter with Comet Halley.

Ph.D. candidates Pamela Puhl and Randall Splinter are among the newest recipients of Graduate Student Research Awards, administered by NASA.

The fellowships provide \$22,000 a year for three years and include tuition, travel money, and a salary. Puhl's dissertation topic will be "Models of Energetic Ions and Neutral Atoms," supervised by Tom Cravens. Splinter will study "Mock Gravity Driven Galaxy Formation from Radiative Decay of Dark Matter" with Adrian Melott. Previous GSR award winner Ned Keller attended the NASA-GSR Fellowship Symposium in Washington, D.C. in May, where he presented a talk titled "Model of Titan's Atmosphere," work conducted under the supervision of Tom Cravens. One of our newest gradu-



**Senior David Babb won a national contest for best atmospheric science paper.**

ate students, Ahilleas Maurellis, has received a Fulbright Graduate Fellowship to study cosmology here at the University of Kansas with Adrian Melott. Maurellis comes to us from the University of Cape Town.

Our undergraduate majors in physics, atmospheric science, and astronomy accumulated quite a few awards as well. Atmospheric science student David Babb received the American Meteorological Society's Father James B. Macelwane Award for the best paper by an undergraduate student in atmospheric science. Babb's prize-winning paper was titled "Effects of Environmental Lapse Rates on the Formation of the Denver Cyclone: A Numerical Study" and grew out of a semester project in a Numerical Weather Prediction class taught by Professor Raymond Arritt.

Undergraduates Kurt Dominik and Marian Sheeran each received Undergraduate Summer Research Awards from the College Honors Program, in both cases to pursue research projects in cosmology. Dominik and physics major Todd Pellman work with Professor Melott on

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## Letter from the chair

Once again, as we prepare our annual newsletter, I am pleased to be able to tell you about some of the events and activities that have taken place during the past year and the effects they have had upon our program.

There have been a number of developments relating to faculty in our department. In fall 1991, Sergei Shandarin formally joined the department with the rank of professor. During the two years prior to that, he was at KU as a visiting professor on leave from the Institute of Physical Problems in Moscow. We were very fortunate to be able to induce him to join our permanent staff. Professor Shandarin is renowned in the field of astrophysics and cosmology and together with Adrian Melott, forms the nucleus of a strong research group in this rapidly growing area. Another faculty member, Tom Cravens, was recently promoted to the rank of professor. Cravens is a relatively recent addition who joined our department in 1988; he works in space/plasma physics and, together with Tom Armstrong, is responsible for a flourishing program in this area. Finally, Professor John Ralston recently returned from a sabbatical spent at the École Polytechnique in Paris, bringing the elementary particle theory group back to full strength.

The department welcomed a number of visitors during the past year. Barbara Ryden was a visiting assistant professor during part of the spring semester, doing research with the cosmology group; she was on leave from the University of Toronto. Anatoly Klypin of the Institute of Applied Mathematics, Moscow, and the Canadian Institute of Theoretical Astrophysics also visited the department during the spring semester to work with the cosmology group. He will return to KU in November and remain with us as a research associate through spring 1992. During the summer, Professor Tom Armstrong hosted visits by Barry Mauk (Applied Physics Lab), Steve Joy (UCLA), Joan Feynman and Guy Spitale (Jet Propulsion Lab), and Ron Zwickl (NOAA Space Environment Lab) as part of his ongoing research program in space physics.

On the teaching front, the university was dealt a harsh blow this summer when lightning struck Hoch Auditorium and it burned down. Large classes which used this building have had to be rescheduled elsewhere. In particular Physics 114 (College Physics I) is being taught in Woodruff Auditorium of the Kansas Union, posing major logistical problems, primarily with regard to presenting lecture demonstrations. On the positive side, we hope that a modern

building geared toward instruction in the sciences will rise in place of Hoch. At present this is more of a hope than an established fact, and the university is still considering its options.

Research in the department continues to thrive. External funding is holding at about the level of the record high established a year ago, and the prospects for the future are good. The experimental high energy physics group has started to consider long-range planning for future SSC experiments, along with a consortium from other interested universities. During the past year this consortium received \$500,000 to begin work in this area. The High Tc Lab, under the direction of Professor Ken Wong, recently received a patent for producing a high Tc superconductor; a Science Advisory Board for this lab has been appointed consisting of Professor T.D. Lee (Columbia University), Professor Max Dresden (SLAC), and Professor Y.H. Kao (Superconductivity Institute, SUNY, Buffalo). A more detailed account of the research activities of the various groups in the department is presented elsewhere in this newsletter.

Our students, both at the graduate and undergraduate level, continue to be a source of great pride. Two graduate students in the department (Pam Puhl and Randy Splinter) recently received NASA Graduate Student Researcher Awards, which pay more than \$15,000 per year in salary plus expenses, for a total of \$22,000 per year; the department received two out of the 80 new NASA awards. At the undergraduate level, two of our majors (Kurt Dominik and Marian Sheeran) each received Undergraduate Summer Research Awards from the College Honors Program to do work in cosmology. John Beacom, a senior who graduated last spring, was named an NSF Graduate Fellow in Physics, one of only 70 new awards nationwide; his total support will exceed \$20,000 per year. Beacom plans to work toward a Ph.D. at the University of Wisconsin.

As you may recall from last year's newsletter, we were required by the Kansas Board of Regents to formulate goals for our undergraduate degree programs and to devise plans to assess how successfully these goals were being met. The first assessment was conducted in 1990-91, and this year we again expect to contact alumni and conduct a survey that will examine their progress since graduation and evaluate how well their KU education prepared them for subsequent careers. A different subset of students is being contacted each year. We would ap-

preciate your carefully considered response to this survey when contacted; a high response rate is desirable in order for the results to be meaningful. We would like to take this opportunity to thank those of you who took the time to respond to last year's questionnaire.

Finally, we would like to thank all of you for your continued interest and support; contributions made through alumni giving have made it possible for us to augment a number of important departmental activities. It is important that there continue to be strong links between the department and its alumni and friends; we are very interested in hearing from you about milestones in your lives and careers and will include any information you send us in future newsletters. Please be sure to keep us informed of changes in your address; only then can you be sure that the newsletter will reach you. We are, of course, always happy to greet visitors in person and hope that you will make it a point to visit us when next in the general vicinity of Lawrence. ■

Sincerely,

Ray Ammar, chair

## Publications

This is a rather small selection from the publications list by department faculty and researchers, who published more than 80 papers between August 1990 and August 1991! Papers highlighting collaboration with students or alumni are featured here:

"Study of  $D^0$  Decays into Final States with  $\pi^0$  or  $\eta$ " by CLEO collaboration (which includes professors Raymond Ammar, Philip Baringer, Robin Davis, and Nowhan Kwak, Steve Ball [PhD89] and Don Coppage and graduate students Ned Hancock, Mike Kelly, Ha Lam and Sangryul Ro) in *Physical Review*, D43, 2836 (1991).

"Effect of Magnetic Overshoot on Shock Drift Acceleration" by Joseph Giacalone (PhD91) and Professor Thomas Armstrong in *Journal of Geophysical Research*, 96, A3, 3621 (1991).

"The Metallicity of Southern Hemisphere RV Tauri Stars from Moderate Resolution Vidicon Spectra" by Adjunct Assistant Professor Scott Baird in *Bulletin of the American Astronomical Society*, 23, 944 (1991).

"Combined Energy and Pitch Angle Diffusion of Pickup Ions at Comet Halley" by Gang Ye (postdoctoral fellow)

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# PROGRAM NEWS

## Theoretical high energy physics

The High Energy theory group, headed by professors Doug McKay, Herman Munczek, and John Ralston, has been busy this past year.

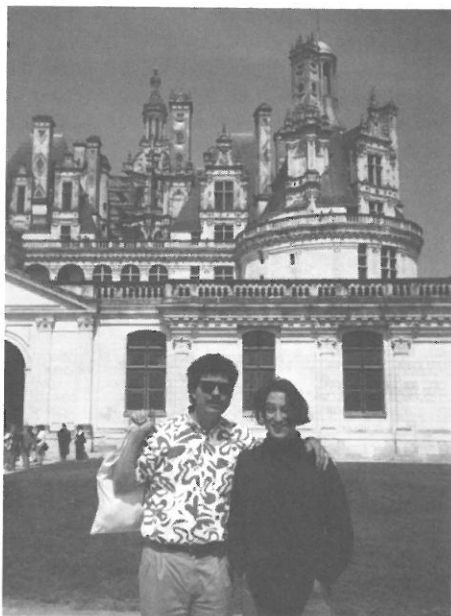
Although particle physics is nearly always an exciting field, this year has been unusually hectic because of new and exciting data. The low-energy particle (LEP) detector at CERN has turned out to be a steamroller, squashing speculative "non-standard" models of particle physics in its path, while FermiLab pursues the hunt for the top quark. Dark matter is constantly in the news, mainly due to what is UNKNOWN about it, while neutrinos, quarks and gluons, leptons and photons continue to be counted without prejudice.

The KU group handles all these things, and more. Last year, McKay and collaborators at Iowa State published several papers on "technicolor," a speculative theory used to predict W and Z boson masses. The theory and some of the collaboration's predictions could be tested at the Superconducting Super Collider (planned for construction in Texas).

A somewhat more "mundane" collaboration between McKay and Ralston involved a proposal to detect ultra-high energy neutrinos via radiation transmitted through ice at the South Pole; although this may sound sufficiently novel, the reality is even more strange, because the neutrinos would be heading UP (down there!) after having passed entirely through the Earth.

Herman Munczek and Postdoctoral Research Associate Pankaj Jain studied the internal plumbing of mesons, namely, their quark wave functions, calculating in the process Practically Everything Happening within  $10^{-13}$  centimeters. Believe it or not, it takes a lot of work to get quantum chromodynamics right, even for a single meson! Jain, who completed his Ph.D. at Syracuse University, also worked on color transparency for skyrmions (or, can a soliton that might be the proton look smaller than it actually is, and penetrate a nucleus at high energy without breaking it up?).

Upcoming experiments at SLAC and Brookhaven will tell us, among other things, why John Ralston spent much of his sabbatical year in France on his own color transparency ideas. Munczek also found some novel ways to explain the construction of Goldstone bosons, particles which in the form of the Higgs boson, are the underlying donor of the property of mass.



John Ralston and his son in France.

Particle physics is a beautiful but tangled web these days, with so much known and so much not even guessed at. The KU group has worked on too much to describe here; the annual grant proposal shows 21 publications for the year. We hope, someday, something new proposed by someone in our group will turn out to be right. Science marches on, sort of.

## Experimental low-energy nuclear physics

Professors Stephen Sanders and Francis Prosser are continuing the research program described in last year's newsletter, now assisted by graduate students Kelly Farrar, Asad Hasan, and Da Zhou.

Although their research at Argonne National Laboratory was frustrated most of the past academic year by problems there, the detector development and construction here has proceeded well. (Argonne, along with all the other DOE laboratories, underwent a very rigorous safety inspection, and essentially all operations were suspended until defects were corrected and more stringent safety precautions were instituted.) When accelerator operations at ATLAS resumed in late spring, Sanders and Farrar were able to proceed with testing of the large volume Bragg curve gas detector with a beam, rather than with radioactive sources. This test was successful but suggested the need for some improvements. These were

made during the summer, and a more complete and even more successful test was made in September.

This detector now is ready to be used in experiments scheduled at Argonne. The first of these, scheduled for December 1991, will be an initial exploration of the possible fusion-fission process in the  $^{24}\text{Mg} + ^{24}\text{Mg}$  system, leading to the compound nucleus  $^{48}\text{Cr}$ . This will extend earlier work on the  $^{56}\text{Ni}$  compound system to lower mass and will build on earlier fusion-evaporation measurements with  $^{24}\text{Mg} + ^{24}\text{Mg}$ . If this experiment is successful, it will become a major part of Hasan's Ph.D. dissertation. Since this is an explorative experiment, only charged particle detection will be used, rather than particle-gamma coincidences as in the more recent mass 56 runs. A second experiment which will use the Bragg detector in the scattering chamber and gamma-ray "ball" described last year also has been approved for early 1992.

## Astronomy

The small but busy astronomy faculty at KU continues its commitments to education and research. More than 500 students each year are exposed to our introductory astronomy courses. After a hiatus of three years, the student community organization, Astronomy Associates of Lawrence, has reorganized and is offering the traditional Friday night open house to the KU and Lawrence communities. And perhaps most exciting, a potential site has been selected and plans have begun to move our laboratory and public observing site to one of the area's best-known recreational and nature sites at Clinton Lake.

In their first research collaboration, professors Stephen Shawl, Bruce Twarog, and Barbara Anthony-Twarog are tackling two research initiatives this academic year. The first entailed observation of two stars with the International Ultraviolet Explorer, a satellite observatory focusing on the high-energy spectrum of stars. Two stars known to be extremely deficient in metals will be observed to test two separate explanations for their apparent anomalies. One is suspected to have a small hot companion, which the IUE will easily confirm, if true. The other has a strange ultraviolet spectrum, and the researchers hope that the IUE data will provide clues to its nature.

Another investigation will combine the team's expertise in globular clusters

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# PROGRAM NEWS

## Astronomy

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and photometry with CCD's, and analysis of images with the MidAmerican Astronomical Image Processing Laboratory, to study one of the oldest clusters in the galactic disk. Melotte 66 is distant and dusty, which normally reddens star colors.

We will use a novel means of limiting the true spread of temperature among the stars in the cluster, which will also help to constrain estimates of the amount of dust along the long path from the cluster to Earth.

Shawl and Don Bord (University of Michigan-Dearborn) have been searching for low-luminosity companions to Mira variables by obtaining spectra at Cerro Tololo Inter-American Observatory, at the shortest wavelengths possible.

Research efforts in polarimetry continue, with attention to the extensive data left to Shawl upon the death of Kris Serkowski some years ago. An example of the information available in the data set was Shawl's discovery that V Hya, a star of variable type SRb and a period of 529 days, is also a polarimetric variable.

## Atmospheric science

The wind tunnel laboratory designed by Professor David Braaten now has been operating for about six months, with investigations underway to study the migration (by re-suspension and deposition) of microscopic particles and to develop a method to simplify calibration procedures necessary for the two-dimensional hot-wire velocity probes. The grand opening was a gala event in the department, with special honor given at that time to our machinist, Jesse Nordeng, for his contributions.

A stochastic numerical model has been developed to simulate the migration of microscopic particles which relies on several experimentally obtained parameters. Results appear to be very good and an apparatus is currently being developed which will allow comparison between experimental results and model results.

A few notes about Associate Scientist Moti Segal, resident in the department

since 1989. Segal works with Raymond Arritt, assistant professor. Segal's areas of interest include mesoscale meteorology, environmental energy, Martian boundary layer processes, and general topics in numerical modeling. Moti returns occasionally to his home in Tel Aviv. ■

## Condensed matter

The U.S. patent granted to Kai-Wai Wong and collaborators Peter Chin Wan Fung, Zhengzhi Sheng, Fui Tak Chan and Wai-Yim Ching brings credit to KU and to the universities of Arkansas, Hong Kong and Missouri-Kansas City.

The patent is for a 110-degree superconductive ceramic based on vanadium. This patent is only the second granted for materials superconductive above 77 degrees, the temperature of liquid nitrogen.

The process, which creates the vanadium compound sandwiched between silicon layers, also is unusually free of hazardous byproducts.

The private research corporation, Midwest Superconductivity, Inc., led by Wong is headed by former Kansas governor John Carlin and includes three full-time scientists, Xin Fei, C.X. Fan, and Ying Xin, as well as four graduate students, D.F. Lu, G.F. Sun, Bingruo Xu, and Naser Alzayed. Xin, one of the most recent additions to the group, completed his Ph.D. at the University of Arkansas under Professor Z.Z. Sheng. Xin joined the High Tc Lab on June 1, 1991.

MSI hosted the first meeting of its scientific advisory board at its new location on Wakarusa Drive (formerly Dragstrip Road for former Lawrence residents), part of Lawrence's growing industrial park on the western edge of the city. ■

## Experimental high-energy physics

The main focus of the Kansas Experimental High Energy Physics Group - Professors Raymond Ammar, Philip Baringer, Robin Davis, and Nowhan Kwak - is its participation in an experiment called "CLEO II," which is

running at the Cornell electron-positron storage ring (CESR) in Ithaca, N.Y. The group also has been participating in the planning of the large-scale detectors for the SSC and expects to get more deeply involved in SSC work in the near future.



Philip Baringer

In Ithaca, the CESR storage ring circulates electron and positron beams of energy 4.5-5.5 GeV which, when collided, provide sufficient energy to produce particles containing the b (or bottom) quark, the heaviest quark that has been observed to date. The CESR machine ran well during the past year and established itself as the world's highest luminosity electron-positron collider. This has allowed the CLEO II detector to collect data corresponding to roughly 700 inverse picobarns since the detector began operation in October 1989. In practical terms this means roughly three million hadronic events have been recorded. In these events are contained some 1.5 million examples of decays of the B meson. This meson contains the b quark bound with a light (up or down) antiquark. By studying the decays of the B meson, the CLEO II experiment can test many of the most fundamental aspects of the standard model of the electroweak interaction. The CLEO II collaboration plans to take data for several more years, accumulating something like ten million B meson decays. A sample of this size will allow us to test many of the predictions of the standard model and to look for new phenomena which might point to new physics.

Peter Haas, research associate, left the group, and is now working at Fermilab. The group has added Steven Ball, who received his Ph.D. from KU in 1989 and, prior to joining the KU group as a research associate, was working for the Max Planck Institute in Heidelberg, Germany. Ball joins the group's other research associate, Don Coppage, in Ithaca, N.Y., where they are on the front line of the effort to extract interesting physics from the large amount of data taken by the CLEO II detector at CESR. Four research assistants, Ned Hancock, Mike Kelly, Ha Lam, and Sangryul Ro, also are stationed in Ithaca, and hope that the nuggets of physical insight they extract there will lead to their doctoral degrees.

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Kai-Wai Wong



Raymond Arritt

# P R O G R A M N E W S

## High energy physics

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The four faculty, unfortunately, cannot be stationed in Ithaca as they are occasionally called upon to teach classes in Lawrence. (But these faculty do accumulate frequent flyer mileage between KCI and Ithaca.)

Even though the SSC will not produce any data until the year 2000, physicists are planning experiments. The Kansas group joined some three hundred other physicists on a proposed large-scale (both in size and price) experiment called EMPACT (for Electrons, Muons, Partons with Air Core Toroids). The SSC program advisory committee, in its wisdom, chose not to encourage that proposal, and Kansas has been meeting with proponents of the two large detector proposals which are moving forward. The two large detectors endorsed by the SSC PAC are named SDC (for Solenoidal Detector Collaboration) and GEM (for Gammas, Electrons, and Muons). Don't be surprised to read in next year's Momentum about work we're doing with one of those groups. (Although we feel neither of them has as impressive an acronym as EMPACT had.) ■

## Theoretical cosmology

Cosmology at KU continues to grow, with the welcome addition this past year of Professor Sergei Shandarin. The cosmology group has expanded further by hiring research associate Anatoly Klypin, a 1980 graduate of Moscow State University. Klypin is



Sergei Shandarin

keenly interested in the related subjects of dark matter and the large-scale structure of the universe and has worked previously at the Institute for Space Research in Moscow and more recently at the Canadian Institute for Theoretical Astrophysics in Toronto.

Most of the cosmologists' efforts are directed toward understanding how structure in the universe could have developed from gravity. However, Ph.D. candidate Randall Splinter will use his NASA Graduate Student Researcher Fellowship to probe possible scenarios of "mock gravity," or clustering impelled by

radiation pressure from decaying dark matter particles such as neutrinos. Professor Adrian Melott has been studying visualization techniques in order to better follow the development of structure in his simulations. He has produced a video which will be published in the *Astrophysical Journal* along with several papers analyzing various aspects of the simulations.

Computing capability plays such a large role in cosmology because it provides the means to experiment numerically; the KU group is pleased to have entered the UNIX environment with the purchase of a Silicon Graphics personal IRIS workstation (4D/35RG), nicknamed KUSMOS. The cosmology machine has 128 megabytes of memory, more available to a user than any machine on the campus, and has a calculating speed five times higher than a VAX 3800. It was purchased with funds from NASA and the College of Liberal Arts and Sciences of the University of Kansas. ■

## Visits

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NSF-sponsored research in cosmology, funded to support research experiences for undergraduates.

Professors Edward Zeller and Gisela Dreschhoff were honored by the "Explorer's Club" at its annual dinner in New York City this past March. The pair was honored for scientific work on the Antarctic continent. Zeller and Dreschhoff spent May as guests of the Physics Department of Zhengzhou University in Henan, Peoples Republic of China, helping to arrange a development project with support of the World Bank. Dreschhoff and Zeller were appointed Honor and Visiting Professors at Zhengzhou University.

Visiting Assistant Professor Claude Laird and wife Diana had a daughter, Larisa, on August 12, 1991. A second son was born to Professor Ray Arritt and his wife, Tere. The Baringers had a baby girl in November 1991.

Of course, many of our faculty members are active in service within the university and in the larger communities of their profession. A few related activities and events are described here:

Professor Kai-Wai Wong has been named Outstanding Kansan in Science for 1990 by the Topeka Capitol Journal.

Professor Barbara Anthony-Twarog has joined the Board of Editors of the

Astronomical Society of the Pacific. This organization, composed of professional and amateur astronomers, is joining the American Institute of Physics as a member organization.

Professor Jack Davidson has been elected vice president of the Kansas Academy of Science. Davidson will begin a three-year term of service on the Committee for Graduate Studies in the College of Liberal Arts and Sciences.

Professor Stephen Shawl is beginning a similar term on the College's Committee for Undergraduate Studies and Advising. Shawl's intense activity on behalf of astronomy education continues with his service on the Education Advisory Board of the American Astronomical Society. He has been added as a co-author to the next edition of the textbook "Discovering Astronomy" and also continues his career as a Harlow Shapley lecturer for the American Astronomical Society, a program that brings professional astronomers to visit at smaller colleges throughout the country.

Professor Robert Friauf is beginning a three-year term on the University Council and is a member of the Committee on Organization and Administration.

Professor Nowhan Kwak has been appointed treasurer of the Association of Korean Physicists in America, a group with a membership of approximately 1,000. He is also a committee member of the Korean Scientists and Engineers in America. ■

## Space physics and geophysics

The department was glad to welcome Tom Armstrong back to the university after his two-year tour at NASA headquarters in Washington, D.C.

While there, he served as head of Magnetospheric Physics in the Space Physics Division. In the past year, he has served as chair of a working group to plan future missions to image the inner magnetosphere of Earth. He continues to assist in the preparation of data sets from the Low Energy Charged Particle experiments on the Voyager spacecraft. The always-busy space physics research group is even busier since his return, with KU the designated data production center for HiSCALE (Heliospheric Instrument for Spectrum Composition and Anisotropy at Low Energies) instrument data from the Ulysses mission. Ulysses, known orig-

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# PROGRAM NEWS

## Space physics

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initially as the Solar-Polar space mission, was launched from the shuttle Discovery in late 1990, and is already mapping the magnetic properties of the solar system for the first time from a vantage point out of the ecliptic plane.

As well as physically copying and distributing the mission data, the KU group shares responsibility for defining the standardized file and data structures.

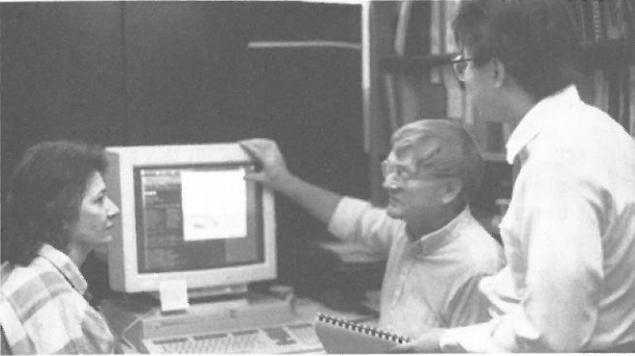
Much of the responsibility for distributing Ulysses data falls to a new member of the space physics working group, Glenda Shelley. Shelley brings management skills to this intimidating task. With a degree in business, she has been a technical support engineer for Informix Software in Kansas City, and an operations analyst of hardware and software systems governing funds transfers for Commerce Bank of Kansas.

Tom Cravens' studies' in planetary aeronomy and magnetospheric physics continue, focusing on comparative studies of the upper atmospheres and ionospheres of the planets and comets. In recent years, numerical models have been constructed which study the properties of ion-electron mixtures and their interactions with the solar wind near the larger terrestrial and Jovian planets, as well as comets and Titan, Saturn's largest moon. The team will continue with improved magnetohydrodynamic models and numerical simulations of planetary and cometary ionospheres, with additional sophistication built into the treatment of ion-neutral chemistry. Some additional features of the model studies will focus on the auroral and non-auroral aeronomy of the gaseous Jovian planets.

Additional studies by Cravens and co-workers focus on the interplay between electromagnetism and gravitational forces on small particles (dusty plasmas), particularly in the environment of comets. Ph.D. candidate Pamela Puhl will be modeling the distribution of ions and

neutral particles in the dense inner coma region near comets, where inter-particle influences are important. Other model studies involving collaboration with J.U. Kozyra (University of Michigan) concern the effect of comet outflow on the impinging solar wind and the interactive evolution of the comet's small magnetosphere.

The Radiation Physics Laboratory, co-directed by Professors Edward Zeller and



From left, Glenda Shelley, Tom Armstrong, and Teck Hock Choo, members of the space physics working group.

Gisela Dreschhoff, conducts research projects in both polar regions. They perform high-resolution analyses in the field on snow sequences. The snow contains a record of ionization from charged solar particles incident upon the upper atmosphere of the earth. The polar ice sheets act as a cold trap which effectively freezes out this signal and retains it in the stratigraphy of the ice, thereby providing a record of past solar activity, particularly of major solar flares. Another related project involves the use of a thermal ice penetrating probe in cooperation with the University of Nebraska. Data acquisition is achieved with automated systems as the probe melts its way to the ice-rock interface. In a third study, the effects of hydrogen gas on the properties of ice will aid in the understanding of glacier movement. ■

## Publications

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and Professor Thomas Cravens in *Journal of Geophysical Research*, 96, A4, 5479 (1991).

"A Net Deposition Model" by Professor David Braaten and K.R. Powell in *Journal of Aerosol Science and Technology*, in press (1992).

"Techniques for Achieving Thermal Equilibrium in Molecular Dynamics Calculations for Solids" by E.Y. Wu (PhD89) and Professor Robert Friauf in *Computational Physics Communications*, 59, 259 (1990).

"Poincaré Algebra and Soliton Energy in Kink Field Theory" by postdoctoral fellow Pankaj Jain in *Modern Physics*

*Letters*, A6, 2363 (1991).

"World Grain Yields, Snow Cover, Solar Activity and Quasi-Biennial Oscillation Relationship" by Visiting Assistant Professor Claude Laird (PhD86), Adjunct Professor Edward Zeller, and Courtesy Associate Professor Gisela Dreschhoff (with R. Laird, KU political science professor) in *Agricultural and Forest Meteorology*, 52, 263 (1990).

"Gravitational Clustering in the Expanding Universe: Controlled High-Resolution Studies in Two Dimensions" by undergraduates John Beacom, Kurt Dominik, professors Adrian Melott and Sergei Shandarin, and graduate student Sam Perkins, in *Astrophysical Journal*, 372, 351 (1991).

"Schwinger-Dyson Equation in QCD: Comparison of Some Approximations" by professors Herman Munczek and Douglas McKay in *Physical Review*, D42, 3548 (1990).

"Energy Dependence of Fusion Evaporation-Residue Cross Sections in the  $^{28}\text{Si} + ^{28}\text{Si}$  Reaction" by Professor Francis Prosser, with colleagues from U. Richmond, Argonne, Notre Dame, Vanderbilt, and MIT in *Physical Review C*, 41, 1005 (1990).

"Hollow Galactic Halos of Fermionic Dark Matter" by graduate student Lesley L. Smith and Professor John P. Ralston in *Astrophysical Journal* 367, 54 (1991).

"Dissipative reaction mechanisms in medium-mass nuclear collision" by Professor Stephen Sanders, with P.M. Evans, A.E. Smith, C.N. Pass, L. Stuttge, B.B. Back, R.R. Betts, B.K. Dichter, D.J. Henderson, F. Videbaek, and B.D. Wilkins in *Nuclear Physics*, A526, 365 (1991).

"A Comparative Study of Daytime Thermally Induced Upslope Flow on Mars and Earth" by Associate Scientist Moti Segal, Z.J. Ye, and R.A. Pielke in *Journal of Atmospheric Science*, 47, 612 (1990).

"Optical Observations of ADS 9193" by Professor Stephen Shawl and D.J. Bord in *Publications of the Astronomical Society of the Pacific*, 103, 1083 (1991).

"A BV Photographic and CCD Analysis of the Intermediate-Age Open Cluster NGC 3680" by Professors Bruce Twarog and Barbara Anthony-Twarog, with Erich Heim (Ast87) and N. Caldwell in *Astronomical Journal*, 102, 1056 (1991).

"Temperature Dependence of the Quantum Interference Periodicity of High Temperature Superconductive Material" by Adjunct Professor Chang-Xin Fan and Professor Kai-Wai Wong in *Modern Physics Letters B*, 5, 1105 (1991). ■

## Alumni news

**N**ews of some recent doctoral graduates: Sun Sheng-Nien finished a Ph.D. with honors and is now a postdoctoral fellow in condensed matter physics at the Georgia Institute of Technology in Atlanta. Ernest Wu (PhD89) is working on magnetic storage devices for an IBM lab in Rochester, Minn. Chi-Kin Lam (PhD87) is using his geophysics background in his job at the U.S. Naval Weapons Center in California, developing smart weapons with target recognition capability. Vaughn Nelson (PhD67), received an academic award in 1990 from the American Wind Energy Association and gave an invited review paper in June 1990 on wind power at the International New and Renewable Energy Conference in Beijing, China.

We were pleased to hear from James Head (Eph64, PhD68). Col. Head went on active duty with the U.S. Air Force in 1968. He has spent about half his military career as a researcher and the other half as an educator, most recently as the head of the physics department at the USAF Academy since 1987. He is involved with the Introductory University Physics Project, a national effort to develop new models for calculus-based courses. The project is jointly funded by the National Science Foundation, the American Association of Physics Teachers, the

American Institute of Physics, and the American Physical Society.

Mac Johnson, (Eph88) is employed as a project engineer for Texas Instruments in the plasma division of TI's Semiconductor operation in Lubbock, Texas. Humberto Campins (Ast77) has been awarded tenure at the University of Florida. James Norcross (Phy84) has completed and defended his doctoral dissertation titled "Nuclear Magnetic Resonance Study of Promoted Catalyst" at the University of Illinois. He will be starting a postdoctoral appointment at the University of Utah in Salt Lake City, working with Dr. D.C. Ailion; Norcross and his wife, Julie, are expecting their third child late in 1991. Cynthia Neyer, (Phy84), completed her dissertation at Iowa State University this past year, studying supersymmetry in quantum mechanics. Steve Kisner, (Atmo85) is employed by the National Weather Service in Topeka as an aviation forecaster. Viewers of Topeka's ABC affiliate station KTKA can listen to another alumnus of this program, Austen Onek (Atmo91), who has joined the forecasting staff.

Electronic mail brings all kinds of news to Malott Hall, including word of important arrivals. We were pleased to hear of the arrival of Matthew Payne, born to Tamara Whitacre Payne (MS88)

and Don Payne (Ast86) on May 17, 1991. The family of Pat Briggs (PhD82) welcomed a second child, Reed Alexander, this past August; father Pat is on the faculty at the Citadel. A second daughter, Alexandra, was born to Mike (PhD88) and Shari Holmes this past June. News from Robert and Ramona (Rusk) Kessel (both PhD87), who have moved to Greenbelt, Md., with their two daughters Bess and Ellen: Ellen is a very recent addition to the Kessel family, having arrived on July 7 of this year. Mona will be working for ST Systems Corporation, contracted to run NASA's NSSDC operation, and will share an office with Ed Bell (PhD90). Bell has been with STX for some time and is shifting his location from Goddard to an off-site location in Greenbelt.

Among these mostly pleasant news items, we have one very sad report of the death of Thomas H. Collison (Phy81), aged 32. Tom's three-and-a-half year battle with Crohn's disease ended on July 16, 1991, at the Baptist Memorial Hospital in Memphis. He is survived by his wife, Joan M. Tholen Collison, and their daughter Elizabeth Anne, aged four. Prior to his illness, he had been a senior systems analyst for Legacy Health Systems in Portland, Ore. ■

## Alumni response

### An important message to our alumni friends

The department receives assistance from the KU Alumni Association and the Office of University Relations to produce and distribute this newsletter. But you help us in this and many other ventures through your contributions to the department's Development Fund. Please take a moment to send some news of yourself and, if possible, a contribution to the fund.

\_\_\_\_ Contribution to the Department of Physics and Astronomy Development Fund enclosed.

Name \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ ZIP \_\_\_\_\_

Country \_\_\_\_\_ Year(s) of graduation, degree(s), and program(s) \_\_\_\_\_

Alumni information for this newsletter \_\_\_\_\_

\_\_\_\_ Suggestions for improvements or additions to the newsletter: