QUANTA

Newsletter of the Department of Physics and Astronomy

www.physics.iastate.edu

Iowa State University

Winter 2004-2005

In This Issue

GREETINGS

Welcome to *QUANTA,* the new newsletter of the Iowa State University Department of Physics and Astronomy. Our Physics and Astronomy Council chair, Mark Fleming, has been a driving force in this new design, and we welcome your comments and input.

We have also recently redesigned our department Web site (www.physics.iastate.edu), which is undergoing further expansion. There is a separate page for alumni activities, and in the near future we will be installing an interactive database for alumni and friends to enter biographical information. Our next newsletter will have details on this.

Your department continues to be strong with major activities on campus and important roles in national and international collaborations.

Although we limited the number of entering graduate students this fall due to budgetary constraints, we have approximately 80 graduate students in the department. Our undergraduate majors also total about 80.

Extramural research funding is at an all-time high of approximately $10 million per year. Over 90 percent of the faculty have extramural funding, and these research grants support 21 postdoctoral associates as well as our advanced graduate students.

Last year professors John Hill and Michael Tringides were named Fellows of the American Physical Society, bringing the total number of current APS Fellows in the department to 11. Also last year, Joe Shinar and Joe Eitter were recognized for research and service excellence, respectively. In the last five years, departmental faculty and staff have received 12 such awards from the University, the College of Liberal Arts and Sciences and the Alumni Association. Our faculty members have been recognized for teaching and advising excellence over 10 times in the past 10 years, including recognition as College of Liberal Arts and Sciences Master Teachers.

Eli Rosenberg

All this has occurred while our faculty has undergone significant change.

In the past three years, Fernando Borsa, John Clem, Alex Firestone, Doug Finnemore, Bill Kelly, David Lynch, Frank Peterson, Constantine Stassis, Tom Weber, and Bing-lin Young have all retired. However, three scientists joined us in 2003-2004: Charles Kerton (astronomy), Robert McQueeney (condensed matter physics) and Martin Pohl (particle astrophysics). This year we are joined by Adam Kaminsky (condensed matter physics), Bella Lake (condensed matter physics) and Edward Yu (biological physics). These new additions are a growing cadre of young faculty who bring with them exciting research programs and a commitment to innovative teaching.

Our facilities continue to age, and we are rapidly outgrowing them. This year sees the remodeling of the two large lecture halls, Physics 3 and Physics 5. We are surviving by moving the lectures across the street to the MacKay Auditorium, along with our lecture demonstrations. If things stay on schedule, we should be back in the lecture halls next fall, in time to help celebrate the "International Year of Physics."

On a more somber note, this academic year is feeling the effects of last year's cuts in funding by the state of Iowa. Our budget is about 3 percent less than last year's. Despite enrollments that have increased over the last decade, we have lost three faculty positions in three years. The loss of faculty and support for teaching assistants has had an effect on our teaching mission. For the first time in the department's history we have had to limit the enrollment in our large introductory courses. Even with some additional funding by the provost's office, these courses have 200 fewer seats available per semester, compared with last year's capacity.

I am serving on the dean's Budget Advisory Group as the College of Liberal Arts and Sciences tries to deal with the cumulative impact of several years of budget reductions. Within the department, we are attempting to find innovative ways to minimize the impact of these cuts on our teaching, research and outreach missions.

Let me close by wishing you a happy and prosperous New Year and by inviting you to visit the campus and to stay in touch. *Q*

NEW BEGINNINGS

Recent faculty additions bring the department some exciting new research initiatives.

Three scientists joined the Department of Physics and Astronomy in 2003-2004, adding new dimensions to the department's research programs.

Charles Kerton, assistant professor, uses radio and infrared astronomy to study the interstellar medium and star formation. Kerton obtained the Ph.D. degree from the University of Toronto for his work on high-resolution infrared observations of the galaxy. Before coming to Iowa State, he was a postdoctoral Research Associate at the Dominion Radio Astrophysical Observatory, a facility run by the National Research Council of Canada. He was a member of the team responsible for the completion of the Canadian Galactic Plane Survey (CGPS), part of an international effort to map out the entire plane of our galaxy at infrared and radio wavelengths. Data from the CGPS have been used by astronomers worldwide to learn about the interaction of massive stars with the interstellar medium and to determine the magnetic field structure of our galaxy, among other areas of investigation.

Charles Kerton

At Iowa State, Kerton has continued his work with the CGPS data and with complementary survey data obtained with the Very Large Array in New Mexico and the Australia Telescope Compact Array. With colleagues at the National Research Council of Canada and the University of Massachusetts, he has also started a research project investigating how massive stars can trigger star formation in the surrounding interstellar medium.

In addition to his research, Kerton teaches introductory and senior courses in astrophysics and is very active in departmental and university outreach activities related to astronomy.

Robert McQueeney received the Ph.D. degree in physics from the University of Pennsylvania in 1996. He spent nearly seven years as a postdoctoral fellow and staff member at the Manuel Lujan Jr. Neutron Scat-

Robert McQueeney

tering Center at Los Alamos National Laboratory, where he was in charge of the inelastic neutron scattering program in condensed matter physics. He joined the Iowa State University Department of Physics and Astronomy in 2003 as assistant professor.

McQueeney uses x-ray and neutron scattering to study crystalline and magnetic structures as well as fundamental excitations such as phonons (lattice vibrations) and spin waves (collective magnetic excitations). These techniques provide data on the forces between atoms, electrons, and spins, linking these forces to the properties of materials.

Professor McQueeney focuses on the broad class of materials known as correlated systems, which usually possess novel magnetic and electronic properties, some of great technological importance. Correlated systems include high-temperature superconductors, heavy fermions, colossal magnetoresistive materials, Mott insulators, and complex magnetic materials. In addition, McQueeney collaborates with scientists all over the world in the development of instrumentation for the Spallation Neutron Source, a new $1.4-billion Department of Energy facility to begin operation in Oak Ridge, Tennessee, in 2006.

Martin Pohl joined the Department as assistant professor, concentrating in particle astrophysics.

Pohl studies gamma-ray bursts, mysterious flashes that appear to betray violent explosions of massive stars. In a few milliseconds these stellar explosions emit as much energy in a highly collimated beam as the sun generates over its entire lifetime. In most cases, this beam of energy does not impinge on the earth, but, in those rare instances when it does, the source appears to be the brightest gamma-ray emitter in the sky by far. Although the recently observed bursts originated billions of light-years away, every hundred million years or so the earth may be in the danger zone of a nearby burst.

In addition to gamma-ray bursts, a certain group of active galactic nuclei nicknamed blazars also emit gamma rays. Blazars are believed to harbor very massive black holes. Both gamma-ray bursts and blazars involve highly collimated relativistic particle outflows.

In order to measure these phenomena, Pohl participates in two major gamma-ray observatory projects that are complementary to each other. The Very Energetic Radiation Imaging Telescope Array System (VERITAS) is a collaborative effort of Iowa State University with six other U.S. institutions and researchers from Canada, Ireland, and the United Kingdom. The completion of VERITAS will coincide with the launch of NASA's $300 million Gamma-ray Large Area Space Telescope (GLAST), the next large space-based gamma-ray telescope, which will measures radiation of lower energy than does VERITAS.

Martin Pohl

GLAST and VERITAS together will provide a continuous coverage of more than twenty octaves of the electromagnetic spectrum. Iowa State University is the only U.S. institution involved in both projects. Q

BIG BANG

Five Iowa State researchers play key role in creating matter similar to that existing at the birth of the universe.

Sometime during a recent experiment at the Brookhaven National Laboratory in Long Island, New York, something amazing happened.

During that experiment the hottest, densest matter ever observed was created, recreating conditions a fraction of a second after the birth of the universe in the "Big Bang."

Only no one knew about it at first.

"It's not just one moment of time that we can pinpoint," said John Lajoie, associate professor, one of five Iowa State Department of Physics and Astronomy faculty members involved with the project.

After the series of experiments was completed, researchers looked over the vast amount of data obtained. It was then that it was discovered that they might have determined what the universe was like at the beginning of time. Scientists believe that just a fraction of a second after the "Big Bang," the universe was a million times hotter than the surface of the sun, millions of times denser than the heaviest metals, and very small. Because of these conditions, the individual basic elements that make up matter (protons and neutrons) didn't even exist.

"The universe was composed of particles called quarks and gluons, the basic constituents of protons and neutrons," said John Hill, professor of physics and astronomy.

Hill says that some scientists believe that the matter created at the recent Brookhaven experiment is a quark-gluon plasma, a form of matter that scientists believe existed only a few millionths of a second after the "Big Bang."

"The experiment was replicated in reverse," said Craig Ogilvie, associate professor. "After the 'Big Bang' the universe started cooling down. In this experiment we heated up two pieces of matter as hot as we could, bringing us as close as we could to the start of the universe."

The experiments were conducted at Brookhaven National Laboratory's new accelerator, the Relativistic Heavy Ion Collider (RHIC) where gold nuclei traveling at nearly the speed of light collide. Besides Lajoie, Hill and Ogilvie, Iowa State associate professor Marzia Rosati and Fred Wohn, emeritus professor, along with students, engineers and other members of the Iowa State research community, are involved in the project. Lajoie, Wohn and Hill built the first-level trigger for the $100 million PHENIX detector at the RHIC facility.

The trigger helps scientists select the few head-on collisions of gold nuclei most likely to produce the quark-gluon plasma. Without the trigger, the PHENIX detector could not effectively select these events.

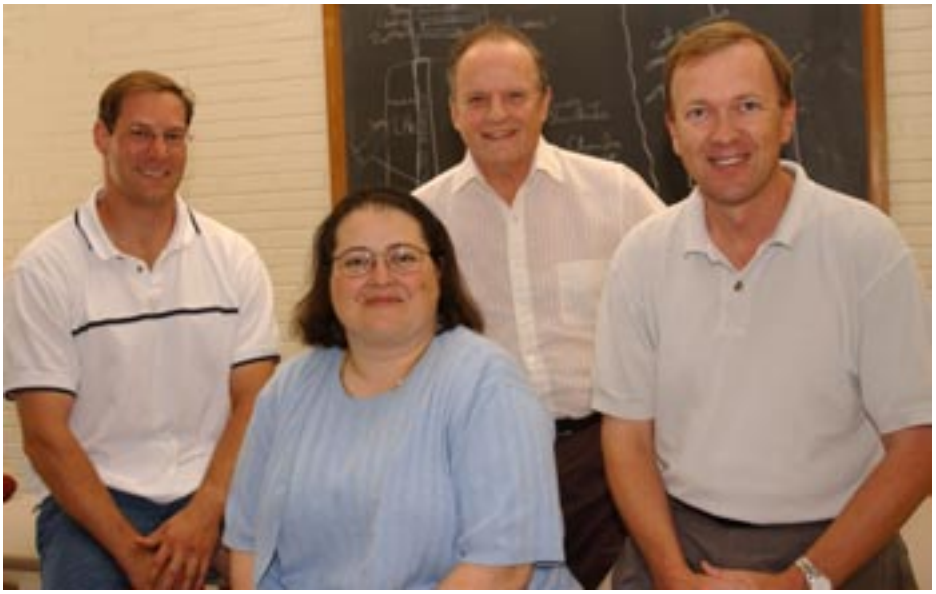
Lajoie and Ogilvie also led part of the analysis of a breakthrough related to the behavior of "jets," which are quarks materializing into swarms of high-energy, subatomic particles. They concluded that the observed disappearance of some jets strongly suggested the brief formation of the quark-gluon plasma.

Ogilvie and Rosati both say that this latest discovery is just the beginning for the PHENIX project, one that Hill, Wohn and others have been working on since 1991.

Future experiments may help researchers further confirm whether the new form of matter observed is a quark-gluon plasma.

"We can now turn to study its (the new matter's) properties and see what the early universe did," Ogilvie said.

"This is a world-caliber research effort," Rosati said. "It has unlimited potential to learn more about the forces that hold matter together and the nature of the universe at the moment of its creation."



John Lajoie, Marzia Rosati, John Hill, and Craig Ogilvie

The Iowa State group is one of the largest U.S. university research teams carrying out research at PHENIX.

Their work has been funded by a series of three-year grants from the Department of Energy. More information on the PHENIX detector and the RHIC accelerator can be found on the web at www.phenix.bnl.gov. Q

PEOPLE MATTER

Strong faculty establish the Department of Physics and Astronomy as a top department at Iowa State–and in the nation.

Eli Rosenberg can talk for hours about the quality of the faculty in Iowa State's Department of Physics and Astronomy.

Above all else, Rosenberg, professor and department chair, says the quality of his department is dependent upon the quality of the faculty.

"In the end it's all about people," Rosenberg says. "And in the Department of Physics and Astronomy we have outstanding people."

Rosenberg cites the research efforts of the physics and astronomy faculty as well as their educational backgrounds as proof of their quality.

But more than that, he likes to mention the number of faculty that are currently receiving funding from off-campus organizations. Rosenberg says every associate professor in the department is on a research grant. He also estimates that over 85 percent of the faculty at both the assistant professor and professor levels are conducting research funded by outside grants.

"We have extremely active faculty that get funding," he says.

Last fiscal year, physics and astronomy faculty received over $9 million in grant support, with two-thirds of that funding routed through the Ames Laboratory of the U.S. Department of Energy (DOE).

"We concentrate on research in a number of areas," Rosenberg said. "But we can characterize what the department does as studying the nature of matter and energy from the smallest scales to the largest scales.

"Our large funding levels are a reflection of the fact that we are doing research that is important to the scientific community as a whole. Our faculty have roles in important projects throughout the world."

The department has five active research areas, including astronomy/astrophysics, condensed matter physics, high-energy physics, nuclear physics, and physics education research. Many of these research areas merge into priorities of DOE.

Rosenberg says that research done by physics and astronomy faculty not only coincides with activities within the Ames Laboratory (particularly in condensed matter physics), but also coincides with activities at similar DOE and other government facilities in the U.S. and the world. In recent years, the department has had significant involvement with programs at Fermilab, SLAC, CERN and Brookhaven.

"We go where the facilities that do first-rate science are, whether it's at Oak Ridge, Tennessee, Argonne, Illinois, or Geneva, Switzerland," Rosenberg said. "What motivates us in the Department of Physics and Astronomy is how do we do the best science.

"We're trying to stay on the leading edge of science and make a major impact in the physics world. By doing that we're giving opportunities to our students to be a part of the forefront of research, wherever it takes place."

Sometimes that science is based on campus, such as the Whole Earth Telescope (WET), a worldwide network of 22 cooperating observatories that obtain uninterrupted time-series measurements of variable stars. WET's international headquarters since 1997 has been at Iowa State where it is directed by Steve Kawaler, with assistance from other departmental faculty and students.

WET is an example of multi-faculty collaborations that are now the norm in the discipline's research activities.

"We need teams of people to be effective in our research efforts these days," Rosenberg said. "That's the way physics is done now. It usually takes more than one faculty member to have an impact on projects of this magnitude.

"More and more of our faculty are utilizing national facilities as more work takes place off-campus than on."

An example of the department's shift to larger collaborations is a team at the Brookhaven National Laboratory. Five departmental members (John Hill, John Lajoie, Craig Ogilvie, Marzia Rosati and Fred Wohn) were part of a team at the laboratory that

Joerg Schmalian

Curtis Struck

recently recreated conditions that existed a fraction of a second after the birth of the universe in the "Big Bang."

The experiments were conducted at Brookhaven's new accelerator, the Relativistic Heavy Ion Collider (RHIC). Lajoie, Wohn and Hill built the first-level trigger for the $100 million PHENIX detector at the RHIC facility, a device essential to the project.

And the five faculty members weren't the only Iowa State physics community members involved in the project as departmental students and engineers also participated.

"By concentrating our efforts, Iowa State receives institutional recognition in addition to the individual recognition of our faculty," Rosenberg said.

Still, individual faculty members in the Department of Physics and Astronomy do get recognized.

Recently two members, John Hill and Michael Tringides, were named Fellows of the American Physical Society (APS), increasing the number of APS fellows in the department to 13.

Other major faculty awards in recent years include

- Alan Goldman–DOE Outstanding Scientific Accomplishments in Materials Chemistry.
- Bruce Harmon, Kai-Ming Ho and Costas Soukoulis–DOE Science 100 Award. Soukoulis and Ho also have received the DOE Energy 100 Award.
- Frank Krennrich–DOE Outstanding Junior Investigator Award.
- Costas Soukoulis–Fellow of the American Association for the Advancement of Science (AAAS).

The department has also been honored for its accomplishments on campus. In the past two years, seven different faculty members have been recognized either by Iowa State or the College of Liberal Arts and Sciences for their research, teaching and advising.

Costas Soukoulis

All of which has helped the Department of Physics and Astronomy to be a highly ranked academic department both on and off campus. In the most recent National Research Council (NRC) rankings, the department was the third highest-ranked department at Iowa State. Q

John Hauptman with a student group at Fermilab

MAKING A DIFFERENCE

Alumni and colleagues return to campus to support the department in alumni relations, industrial liaison, and strategic planning.

Marking its twelfth anniversary, the Physics and Astronomy Council continues to advise and help the department in various activities. The council consists of alumni from a spectrum of professions, including education and academic research, industrial research, and general management.

Members of the council in 2004 included

- Dr. Robert Amme, Department of Physics, University of Denver
- Dr. John E. E. Baglin, IBM Almaden Research Center, San Jose, California
- Dr. Leon D. Crossman, Midland, Michigan
- Dr. Charles L. Duke, Department of Physics, Grinnell College, Grinnell, Iowa
- Dr. Bernice B. Durand, Department of Physics, University of Wisconsin–Madison
- Dr. Douglas K. Finnemore, Department of Physics and Astronomy, Iowa State University
- Dr. Mark W. Fleming, Strategies on Demand, L.L.C., Naperville, Illinois
- Dr. Alan I. Goldman, Department of Physics and Astronomy, Iowa State University
- Dr. John Hopkins, Conoco, Inc., Houston, Texas
- Dr. Michael Klein, Jet Propulsion Laboratory, Pasadena, California
- Dr. Robert L. Mather, Oakland, California
- Dr. Alfred Mueller, Department of Physics, Columbia University, New York, New York
- Dr. Derek Pursey, Dubuque, Iowa
- Dr. Eli Rosenberg, Department of physics and Astronomy, Iowa State University
- Dr. Thomas D. Rossing, Department of Physics, Northern Illinois University
- Dr. James E. Schirber, Hermosa, South Dakota
- Dr. Robert N. Shelton, The University of North Carolina–Chapel Hill
- Dr. Joseph Shinar, Department of Physics and Astronomy, Iowa State University
- Dr. Clayton A. Swenson, Ames, Iowa
- Dr. Willard L. Talbert, Jr., Santa Fe, New Mexico
- Dr. Daniel J. Zaffarano, Ames, Iowa

The group meets annually in May. In order to focus on initiatives of greatest importance to the department and to make progress between annual meetings, the council has formed working committees in the areas of alumni relations, industrial relations, and strategic planning.

Led by Robert Amme, the Alumni Relations Committee organized a weekend event in connection with the 2002 council meeting to celebrate the career of Daniel J. Zaffarano, former department chair, dean of the graduate college, and Iowa State University vice president for research. The festival was attended by approximately 200 colleagues, alumni, and friends.

The Industrial Relations Committee was formed to work with the department to identify and pursue opportunities for collaboration with industry through a variety of initiatives, including joint or sponsored research, internships, colloquia, and student placement.

The Strategic Planning Committee offers an external perspective and sounding board to the department in its efforts to build on its strengths and respond to the opportunities and challenges of this decade. In 2001 the committee compiled quantitative data on the market for physics and physicists and projected some of the major research trends over the next several years. Recently the department organized an internal long-range planning committee to develop a plan to exploit these opportunities and to communi-

GET INVOLVED!

1. ***Get the latest news*** on our research, education programs, faculty, and alumni at www.physics.iastate.edu.
2. ***Get in touch.*** We welcome your suggestions and comments! Let us know what you think about this newsletter, about current initiatives in the department, and about ways that we could help you. Please contact Eli Rosenberg, department chair, redmount@iastate.edu, or Mark Fleming, council chair, stratondmd@aol.com, with your thoughts or questions.
3. ***Keep us posted*** on your career, interests, family, and contact information by updating your profile at www.physics.iastate.edu.
4. ***Dig deeper.*** Are some of our initiatives of interest to you and your organization? Please contact Eli Rosenberg to arrange a briefing with the appropriate people, either by telephone or in a personal visit on campus.
5. ***Contribute your time, talent, or resources.*** We could use your experience, perspectives, and hands-on help in some of our initiatives. We also welcome financial donations, either unrestricted or designated for any of a number of areas of needs, including scholarships, facility improvements, or major capital endowments.

Physics and Astronomy Council reception following the meeting on May 15, 2004

cate the goals of the department to the university administration and the larger community.

Department chair Eli Rosenberg believes that the Physics and Astronomy Council brings fresh outside perspectives and insights to the current issues facing the department. "I look forward to our annual meetings, when we can update the group on the state of the department and share ideas freely. My colleagues and I have benefited from their advice in helping us to distinguish between 'applied physics' and 'physics with applications,' and in improving our outreach efforts."

And what about future initiatives? Mark Fleming, incoming council chair for 2004-2006, has four priorities:

"First of all, I hope that we can broaden the demographics of the council, including graduates from the 70s and 80s who have gone into industrial positions as well as into professions outside physics.

"Second, we need to pursue additional specific initiatives to enhance liaisons with industry. This is a particularly important objective, considering the department's rich portfolio of research and intellectual property as well as today's reality of declining federal support.

"Third, I believe that we should identify and support some specific opportunities for alumni contributions of talent and funds for worthy purposes in the department.

"Finally, we hope to work closely with the department in the development, communication, and advocacy of its vision and roadmap to the future."

No small undertakings–but after twelve years, the council and department have become productive partners. Q

PERSONAL MILESTONES

Fellowship is nice, by Michael Tringides prefers the excitement of discovery.

Michael Tringides has joined a very exclusive group.

But Tringides, professor of physics and astronomy and Ames Laboratory senior physicist, is more excited about the discoveries he and his research group have made in recent years than his election as a Fellow of the American Physical Society (APS).

"It (APS Fellow) means something for sure," he said. "But it's the work that you perform that makes the difference to me. You know what is important in your work and which work is a milestone."

At least two milestones have occurred for Tringides in recent years. First, and foremost, is the discovery his group made in finding an unusual growth mode at low temperature. Contrary to conventional expectations,

Michael Tringides

the group found that uniform height metal islands can be grown on silicon substrates. The discovery has led to novel ways to control growth of uniform atomic-scale structures.

The work done by Tringides and his research group (associate scientist Myron Hupalo and graduate students Vincent Yeh and Michael Yakes) is basic research within the U.S. Department of Energy's Ames Laboratory to learn more about the microscopic processes that control the growth of custom-made materials.

It is essential for atomic structures and ultrathin metal films to be grown in uniform sizes and with highly ordered geometries for technological applications that can include switches, lasing materials and semiconductors. Such atomic structures will allow computer chips to run faster.

The work of the group may prove critical in the further miniaturization of silicon-based electronic devices, a major undertaking in light of the silicon industry's huge role in technological innovation and production.

"It's essential that these structures are grown in a robust and reproducible way, with easy size selection," he said.

Tringides originally published his group's findings in 2000. Because of the surprising and intriguing results, Tringides attempted to interest other groups in the research.

He thought he had a group from Taiwan excited about the project.

"But we didn't hear from them for a long time," he recalled. "Then there was this earthquake in Taiwan. I thought maybe their lab was destroyed and they wouldn't be able to work on the project."

Soon after the earthquake, Tringides received an e-mail from the group.

"That was really thrilling for me," he said. "Not only did they look at similar work, but they fully confirmed our unexpected discovery," he said. "Having someone confirm your novel discovery–now that's a thrill. The impact of the work will last forever, even if the research is reviewed 100 to 200 years from now."

Tringides estimates six groups are now working on the issue worldwide as a result of their pioneering discovery.

But it is not the only milestone in Tringides' research career.

Just last year his group published research on the "devil's staircase" phase diagram. This is one of the outstanding theoretical predictions in statistical physics and its realization in nature has been a great challenge to experimentalists. This discovery is one of the best case examples of a "devil's staircase" ever found.

"Hopefully others will begin to do experiments along the same lines," Tringides said.

Ironically, Tringides was honored by the APS not for these recent discoveries, but mainly for his earlier work on surface diffusion. He was honored for "his pioneering contributions in the elucidation of equilibrium and nonequilibrium adatom diffusion on single crystal surfaces."

Tringides was one of two Iowa State physicists named an APS Fellow, an honor granted to no more than one-half of one percent of the current membership of the Society. The election by their peers of Tringides and John Hill, professor of physics and astronomy, brings the number of APS Fellows in the Department of Physics and Astronomy to 13. **Q**

IN MEMORIAM

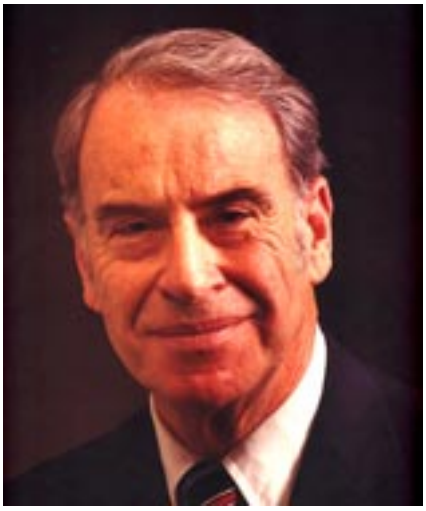
Daniel J. Zaffarano, former department chair, dean of the graduate college, vice president for research–and a personal friend to many.

Iowa State University lost a longtime leader and friend with the passage of Daniel Zaffarano on December 3, 2004.

Daniel Joseph Zaffarano was born on December 16, 1917, in Cleveland, Ohio. He received the B.S. degree in physics from Case Institute of Applied Science in 1939 and worked on the development of high-performance batteries for the proximity fuze during World War II. After earning the M.S. and Ph.D. degrees in physics from Indiana University, he joined the Iowa State University Physics Department in 1949. As research associate professor, he studied photonuclear reactions triggered by bremsstrahlung x-rays from the newly acquired 70 MeV synchrotron in the Ames Laboratory.

In 1956 Dan moved to London for a two-year assignment as nuclear research liaison scientist for the Office of Naval Research.

Following his return to Iowa State University, he was appointed chair of the Department of Physics as well as Physics Division chief of the Ames Laboratory in 1961. In addition to his administrative duties, he carried on research in neutron scattering, using the laboratory's five-megawatt heavy-



Daniel J. Zaffarano, 1917-2004

water reactor that became operational in 1964. He also earned the title of distinguished professor in 1967. During his tenure as chair, a new five-story addition to the venerable Physics and Astronomy Building was funded and substantially completed.

In 1971 Dan was named vice president for research and dean of the graduate college, positions that he would hold until his retirement in 1988.

As a scientist with a strong interest in applications, he sponsored some major initiatives to make energy generation more efficient and economical. He was division chief of the Iowa Coal Research Project, a five-year effort that demonstrated a significant cost saving by mining and processing Iowa coal instead of importing higher-quality coal from the western states. He was general chairman of The First International Conference and Workshop on Iceberg Utilization for Fresh Water Production, Weather Modification and Other Applications, held at Iowa State University in 1977.

Dan also had a vision of Iowa State as a major force in biotechnology. In 1984 he brought a number of active but largely independent researchers from five colleges together to form the Biotechnology Council. Over the next three years, a major biotechnology program was launched at Iowa State, and funding was awarded for construction of the Molecular Biology Building. To this day, the Biotechnology Council remains a model of interdepartmental, interdisciplinary collaboration as the university's initiatives have continued to grow at the intersections of the biological and the physical sciences and humanities.

Dan continued to serve the department and the university in numerous initiatives after his retirement. He also enjoyed life outside the academic setting. A lifelong music lover, he was the founder, president, and a singer in the Ames Choral Society and president of the Ames Town and Gown Chamber Music Association. He was an avid gardener and spent many hours on projects in his home shop.

He is survived by his wife Suzanne (Suzy), son Dario, daughters Erica, Elisa, Bianca, Gina, and Monica, and a large extended family, to which he was deeply devoted.

Dan was a gifted physicist and an energetic, effective leader. He created a pleasant, collegial atmosphere that fostered cooperation. His door was always open to students, faculty, staff, and other visitors. His legacy is measured not only by his professional accomplishments but also by the impression that he has left on the lives of a multitude of students and colleagues, who have lost a dear friend. **Q**

QUANTA is published by the Department of Physics and Astronomy, Iowa State University, for alumni and other colleagues.

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