

Matter Motion

A publication for alumni, friends, faculty and staff of the UMR Physics Department

Norm and Natalie Pond Provide Generous Deferred Gift to Physics

Norman H. Pond (BS '59, PD '97) and his wife, **Natalie**, have recently pledged a deferred gift of \$750,000 to the Physics Department. At the time of maturity, it is expected that a major portion of the fund will endow a physics professorship. In addition to the deferred gift, Pond also donated through his company, Intevac, Inc., a scanning electron microscope with image analysis, and an ultra high vacuum (UHV) pumping and chamber system, as described elsewhere in this Newsletter.



Norman and Natalie Pond

Edward Hale, Chair of the Physics Department, said of the gifts: "The Department is so pleased with these gifts. The deferred gift will provide support for a new distinguished faculty member and will strengthen our program by attracting a renowned physicist to our department. The first use of the scanning electron microscope will be by Prof. **Don Hagen**, who will use it to study aircraft and rocket exhaust particles. Prof. **Dan Waddill** will use the UHV system to further his studies of magnetic alloy films prepared and characterized under UHV conditions."

Norman received a Bachelor of Science degree in physics from UMR in 1959, and a Professional Degree in physics in 1997 for his subsequent accomplishments. He also holds an MS degree in physics from UCLA.

Norm was employed in various technical

and managerial positions at Teledyne and Varian where he was president until 1990. He then left to found Intevac where he is chairman, CEO, and president. Intevac, Inc., is a diversified manufacturer of high technology products in Santa Clara, CA, and was formed by the concurrent acquisition of several businesses that produced equipment for night vision, semiconductor fabrication, and magnetic media. Intevac's primary product is a multi-station, static sputtering system used to produce magnetic thin film coatings on disks used in computer hard disk drives. Through Norm's fine business acumen, Intevac has captured a large share of the world market for such coating systems. The company is also active in designing equipment used to produce flat panel displays, and is doing research and development in the photonics.

Norm has long been an active participant in electronics related industry and military committees. He organized and led the Advisory Group on Electron Devices for the Department of Defense. He has served on the Board of Directors of the Electronic Industries Association, and is presently a director of IDEMA, the leading organization in the disk drive industry.

Norm and Natalie have three grown children, and live in Los Altos Hills, California.



Phonathon 1998

It's that time of year again! Between March 15-18, your phone will ring as a student calls you for your phonathon pledge. This year, alumni have a special opportunity to join in the **Full Circle Campaign**. As you will read elsewhere in this Newsletter, alumni **Norman Pond**, **Ellen Woodman Doll**, and **Charles Rice** have decidedly started the ball rolling. When called, you will be asked to consider making a bigger pledge than usual and making it for the next three to five years. This will help the department achieve its goals sooner and you will have already made your commitment to the success of the **Full Circle Campaign**. (And incredibly, we won't ask for more next year!) So join us and them with your share in completing UMR's Full Circle.

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Memo from the Chair



Ed Hale

Today and Tomorrow

MSM/UMR's first major fund-raising campaign was announced last fall at homecoming. This *Full Circle Campaign* has an overall goal of raising \$60 million for the campus by mid-year 2001. Chancellor (and physicist) **John T. Park** has noted that "The *Full Circle Campaign* will go a long way towards keeping UMR one of the nation's premier universities and will ensure that our students have the tools they

need to succeed in the 21st century."

The campaign's theme focuses on "completing the full circle" with today's donors — the students of the past — being asked to help advance today's and tomorrow's students. The Physics Department's part of the campaign is off to a good start, as mentioned in several featured articles in this newsletter. I hope you are willing to help us as much as you can. One way is to increase your giving to the physics phonathon which is coming up in mid-March.

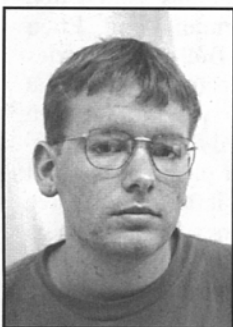
This is a great academic year for a student to be getting a degree. The job market is as good as I have seen it in my thirty years as a professional. Sometimes in the past, a student had to work hard to get an interview, much less a job offer. (I always tell them that finding a job might be one of the toughest jobs of their life.) Recently, however, our students have easily arranged for multiple interviews and have been getting multiple offers. If they have taken a course in C++, as we strongly encourage

them to do, they are in great demand. There is a solid need for good students who are not totally computer programmers, nor accomplished theoreticians, but are pretty good at using computers to analyze and interpret data of various types. Of course, our students are also being hired for other, more "classical" jobs as well.

We continue to attract outstanding undergraduate students. Last semester, of the 15 physics freshmen, 7 got straight A's and three others got only a single B. Two were women, one of whom is on the Lady Miner basketball team. Another freshman is on the track team. One freshman earned a perfect (1600) SAT score. At December's graduation, one of the two marshals for the College of Arts and Sciences (who are selected based on highest rank in the college) was a physics major. Our students have the highest average grade point of majors in any large department at UMR. If you can find the time, we encourage you to come back and look over your department and interact with our students.

Physics Department Awards '97-98 Scholarships

The following scholarships have been endowed through the generous gifts of the friends and family of the UMR Physics Department. Please contact the Physics Department if you would like to add to the endowment fund of these scholarships or would like to establish a new one.



Ryan Feeler

Recipients of the Harold Q Fuller Scholarship/Loan were **Christopher Maloney** of Newburgh, IN, **Ryan Feeler** of Rolla, MO, and **Jessica Allison** of Hannibal, MO. The \$1,000 scholarship-loan was endowed by the late Dr. Fuller, chair of the physics department from 1948 to 1970 and former dean of the College of Arts and Sciences, to recognize outstanding achievements among juniors and seniors in physics. Half of the scholarship

is an interest-free loan that students begin to repay when they start their first jobs. Ryan commented "if I had to spend 20+ hours a week in the workplace, I would not have enough time to concentrate on my studies."

Recipients of the Burke H. Miller Memorial Scholarship were **Glenn Rueff** of Tohatchi, NM, and **Joel Buckley** of Iberia, MO. This \$1,000 scholarship was established by the Miller family to commemorate the academic achievements of their son, Burke, who graduated with a bachelor's degree in physics in 1969 and later died during the Vietnam War. The award is for promising and dedicated students in physics.

Steve Alferink of St. Louis, MO, received the Leon E. Woodman Memorial Scholarship. This scholarship was estab-

lished by the Woodman family in honor of Dr. Leon E. Woodman, Chair of the Physics Department from 1919 to 1948. It is offered to students in physics who are of good moral character, maintain a satisfactory grade point average, and are in financial need.

In addition to the above endowed scholarships, which are usually awarded to juniors and seniors, the department awarded Special Departmental Scholarships to the following students, who range in academic standing from sophomores to seniors: **Jennifer Adams**, St. Louis, MO, **Dan Chitwood**, Barnhart, MO, **James Dent**, Jonesboro, AR, **Carmen Doudna**, Barnesville, OH, and **William Halliburton**, Moberly, MO. Jennifer said of her scholarship "As a new student in the physics department, the scholarship not only helped me financially, but also helped me to feel welcomed and supported in the department. The Physics Department has a closer relationship with their students than many other larger departments and that support is shown in many ways, one being in the form of scholarships."

To Contact UMR Physics

If you would like to contact us for any reason, you can reach us by phone at (573) 341-4781 and by e-mail at physics@umr.edu. You are also cordially invited to check out our evolving Web page at <http://www.umr.edu/~physics>.

Physics Department's Role In the Full Circle Campaign

As the university charts our course for the next century to *educate tomorrow's leaders in engineering and science*, the campus is focusing on its areas of excellence -- those areas that build on our strengths and traditions. The **Full Circle Campaign** is an intensive seven-year effort to increase and focus private support for MSM-UMR. The goals of this campaign have arisen through a planning process involving campus leadership as well as alumni leaders, advisors, and friends.

The Physics Department has a Campaign goal of \$1.1 million, of which 75% has already been committed to date by alumni and friends. The primary focus for physics throughout the Campaign will be to build funds for student scholarships and fellowships, establish an endowed professorship in the department, and form an endowed resource for the continuing purchase of much needed undergraduate laboratory equipment and computer upgrades.

Be sure to read the information and watch the progress on the *Full Circle Campaign* in the *MSM-UMR Alumnus* magazine. Updates on the department's progress will be published in future Newsletters. Remember, it's the generosity of UMR alumni, parents, and friends in completing the full circle -- remembering the past and ensuring the future -- that will help us achieve our commitment to excellence.

Physics' First Alumna Generously Increases Endowed Scholarship

Ellen Woodman Doll (BS '33) has donated \$5,000 to increase the endowment of the Leon E. Woodman Memorial Scholarship Fund. MSM records show Ellen as the Physics Department's first alumna. It was unusual for women to earn degrees at MSM in the 1930's. Her actual degree, in fact, was in Science since neither physics nor chemistry degrees were officially offered at that time.

Dr. Leon Woodman, Mrs. Doll's father, was hired by MSM in 1919 after obtaining his Ph.D. from Columbia University in New York City. He became head of the Physics Department in 1920 and served in that role until 1949 when he retired. He laid a sturdy foundation upon which the department could grow and gain strength. In 1967 the Woodman family established the scholarship fund as a memorial to Dr. Woodman. The interest from the endowment enables the department to award two scholarships annually to students of good character and scholastic achievement who have financial need.

Ellen counts many MSM alumnae among her friends and still keeps in contact with them. She is now a lively retiree after having taught public school for many years. Ellen lives in Charleston, WV, where (among her many activities) she collects unusual musical instruments which she enthusiastically learns to play.

The Physics Department appreciates Ellen's memories and her generosity.

Return to Rolla for Homecoming!

The Physics Department is undergoing continuous improvement and we warmly invite our alumni to return to experience it at UMR Homecoming, on the weekend of Oct 2-3, 1998. On Friday afternoon (October 2), the department holds an open house for its alumni and friends, with special programs presented. This year we will be featuring the new Laser Laboratory. Other tours along with interactions with students will be available.

Following tradition, a physics alumnus or alumna will deliver the 1998 Homecoming Colloquium at 4 p.m. on Friday, October 2. Professors **Ed** and **Barbara Hale** will have a reception that evening in their home for all returning alumni. Come home to your college roots, and celebrate our past and future!

From the President of SPS

My name is **Dan Storey**, and I was president of the UMR chapter of the Society of Physics Students (SPS) last semester.



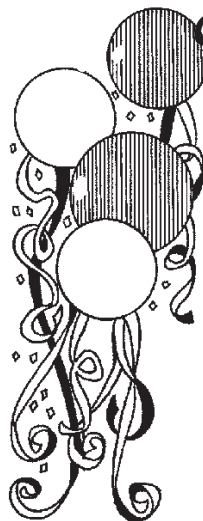
Dan Storey

You may wonder why we changed presidents at the end of the semester. It was a general feeling that some major changes needed to be made in SPS. Last semester, the executive board of UMR-SPS totally re-wrote the constitution. In our new constitution, offices terms are only one semester long. This gives more people a chance at a leadership role in the society. It also permits people

who can only commit a semester to take an active part in SPS. The new constitution was one of our major accomplishments of the semester.

Also, last semester, SPS started a student lecture series in which alumni, faculty and others came to meetings and talked to the students. This was done because undergraduate students have little exposure to the real world of physics at their level. We do have a colloquium series in the department, but speakers generally give talks geared towards graduate students and professors. Physics faculty members **Greg Story**, **Bob Dubois**, and **Allan Pringle** talked about their research. Physics alumnus **Jeff Schroeder** (BS '95) shared his experiences at Hughes with us while he was on a campus recruiting trip. We had many interesting talks, and hopefully expanded the minds of our members.

Our big project for the current semester is our participation in "Two Plus Two" sponsored by the Girl Scouts. One Saturday near the end of February, local girl scouts will visit campus and participate in science activities with faculty and students. We plan to make sundial wristwatches for each girl scout to take home. We are looking forward to this event, and anticipating plenty of sunshine for our "solar-powered" watches!



Congrats to Our 1997 Degree Recipients!

Bachelor of Science

Patrick Berryhill	Hal Burch
Jennie Flynn	Joshua Gary
Shella Keilholz	Kevin Moll
Michael Pinkerton	Brad White
Christopher Shields	

Master of Science

Michael Foster	James Perez
Muzaffer Tabanlı	

Doctor of Philosophy

Gavin Buffington	Chang Shen
Stephen Jones	

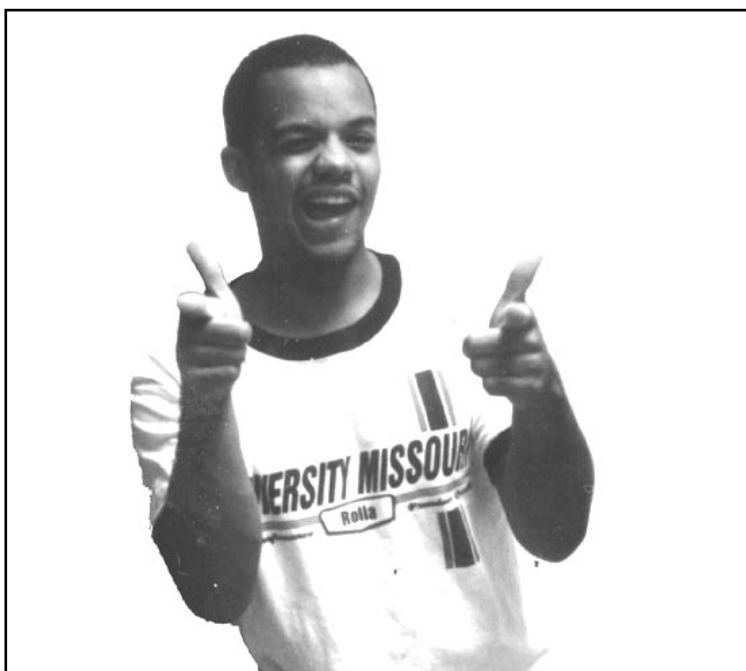
Profile of a New Physics Major Who Heard the Call

Just one year ago, undergraduate **John Johnson** was struggling to keep his head above water as an average mechanical engineering student. Now, as one of the Physics department's newest students, he's not only excelling in the classroom but in many other activities as well. From designing the Physics Department's web page to participating as an active member of the Society of Physics Students, it is clear that John has found a home in the Physics Department.

So what prompted the change? John explains, "I had the grades of a mediocre mechanical engineer, yet I knew that I was not a mediocre student. I wanted to study something that I could have a passion for." A tour of the Physics Department and careful examination of the course catalog convinced him to make the change. And the change has proved to be for the better.

In John's first semester in the Physics Department, he earned a 3.77 GPA. In addition to excelling in the classroom, he still found time for many activities, both in the department and on the UMR campus.

One of John's first undertakings upon his arrival in the Physics Department was the redesign of the departmental web page, located at www.umn.edu/~physics. He has also used his web page design skills to create pages for the Society of Physics Students as well as several other organizations on campus. John's



John Johnson - "I can't keep this pace up forever"

student-run KMNR (89.7 FM) as a deejay and as a business assistant. He also serves as KMNR's representative to Student Council. These activities led to his idea to start a new joint KMNR/Student Council talk show. About the prospect of hosting his own talk show, he says, "I'm really excited. The show is pretty much a first on the UMR campus. It will finally provide a truly open forum for the discussion of issues."

Talk show host, computer jock, outstanding student . . . so what's next for John? "Well, I can't keep this pace up forever. I hope to begin research this summer, but until then it's just the same old stuff!"

computer skills were also put to use over winter break as he worked as an assistant to senior electronics technician, **Brian Swift**. Together they installed new computers in the Physics Computer Learning Center as well as the engineering physics laboratories.

John also works as an undergraduate teaching assistant for Prof. **Ron Bieniek** in the Physics Learning Center. As a self-professed "battle-scarred veteran" of the Engineering Physics program, John says that he enjoys being able to help other students succeed as he did.

Outside the Physics department, John works at

Don Meyer Receives Alumni Service Award

Donald I. Meyer (BS '46) was presented with an Alumni Service Award at Homecoming



Don Meyer

1997 in recognition of his dedicated service to the UMR and the Alumni Association. While at UMR, Don was president of the Music Club, on the Student Council, an honored member of the St. Pat's Board, and the recipient of the A.P. Green Medal for academic achievement. Don received his PhD in nuclear

physics from the University of Washington. After stints at Los Alamos National Laboratory, Brookhaven National Laboratory and the University of Oklahoma, he joined the physics faculty at the University of Michigan at Ann Arbor.

His initial research efforts involved bubble chamber experiments. Don's experimental research took him to accelerators at CERN, Argonne National Lab, Fermi Lab, and SLAC. He designed the spark chamber exhibited by General Motors at the New York World's Fair in 1964. In 1987, he shifted his research to astrophysics with the objective of employing his experimental expertise in particle physics to the detection of high energy gamma rays from astronomical objects.

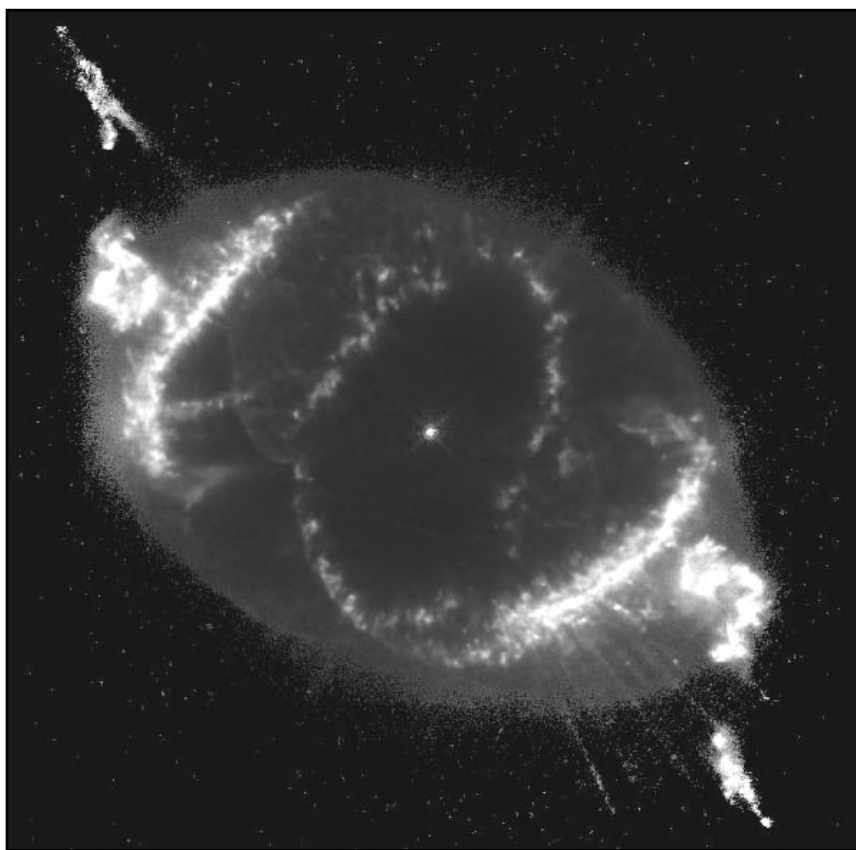
He discovered that, contrary to expectations, quasars as well as supernova remnants emit copious amounts of high energy gamma rays. He has published more than 100 papers in high-energy astrophysics and the interactions and properties of quarks, leptons, and gluons.

During his tenure at Michigan, Don oversaw a \$60 million project to construct a new building for the physics department and also renovate some older ones. He also displayed his UMR heritage at Michigan by initiating a joint program between physics and engineering to train PhD students in the practical applications of modern physics technologies, which led to Michigan's highly successful Program in Applied Physics.

Kaler Gives Harlow-Shapley Lecture

Astronomy and astrophysics are areas of investigation from which we have come to expect spectacular discoveries, usually associated with pictures from the Hubble Space Telescope and "further details in the news at 10:00 pm". Articles in *Scientific American* occur slightly later. Astronomers know a good thing when they see (i.e. observe) it, and the public knows it, too. Over 100 adults and children typically show up at the monthly public Visitor's Nights at the UMR telescope when the event coincides with decent weather. Each year the Physics Department tries to bring in one or two astronomy speakers to give talks on cosmic themes aimed at a general public audience.

This past November astronomer **James Kaler** of the University of Illinois at Urbana-Champaign visited UMR under the sponsorship of the Harlow Shapley Visiting Lectureship Program of the American Astronomical Society. Kaler gave a popular evening talk on "Birth of Stars: Where We Came From".



"Cat's Eye" planetary nebula

(To physicists this translates as where the elements in the periodic table came from.) The lecture was well attended and thoroughly enjoyed by the general public and by students from both Rolla High School and UMR.

Kaler also presented a technical colloquium about his research on planetary nebulae. This type of nebula is a product of the late stage of a sun-like star's evolution, and comprises the distended envelope of mass that has been thrown off of a star that is rapidly becoming a white dwarf.

While at UMR, this astronomer also talked shop with the students taking the department's astrophysics course, did an interview with KUMR radio, and made contacts with department faculty doing work

that may have application to astronomical problems.

It was a very successful visit in terms of furthering interest in astrophysics and physics in general.

We think Harlow Shapley, a graduate of the University of Missouri, would have approved.

Charles Rice Adds Funds to Physics Scholarships

Charles M. Rice (MS '50) has donated additional funds to be used for physics scholarships. Last summer he provided a month's funding so graduate student **Dan Storey** could work towards his MS degree, which Storey expects to earn this summer. This year, Chuck has generously provided two \$1,000 undergraduate scholarships and one \$2,000 graduate fellowship to the department.



Charles M. Rice

Last fall Rice came to UMR to deliver a lecture to the Chancellor's Leadership Class, which consists of 35 freshman selected for their high academic abilities and leadership potential. While here, he was given a personalized tour of the physics department and chatted with many of our students about physics and careers. He listened with interest as several undergraduate students presented short talks to him on their on-going research efforts.

As reported in last year's Newsletter article about him, Rice received a Master of Science Degree in Physics from UMR in 1950, and a Professional Degree in 1996. He currently serves on UMR's Nuclear Engineering Advisory Board. Chuck will continue to play a leadership

role at UMR as a member of the Board of Visitors, a group of individuals selected by Dean **Russell Buhite** to assist with strategic planning for the College of Arts and Sciences.

Chuck was awarded one of the first master degrees in physics from MSM and remembers very fondly working with Dr. **Harold Fuller**. He went on to head the government's nuclear aircraft program for several years, and also to found several companies.

Chuck Rice has eight children and fifteen grandchildren, and makes his home in Idaho Falls, ID. He has been honored by the State of Idaho as one of the 100 people in that state who "make a difference."

Alumni Notes

Special Returnee

Charles W. Myles (BS '69) gave the 1997 Homecoming Colloquium in October on his research in *Molecular Dynamics: A Tool for Probing the Defect Properties of Semiconductors*.



**Charles W.
Myles**

Following his undergraduate years at UMR, Charley went to graduate school at Washington University in St. Louis, where he received his PhD in physics in 1973. He has had a very distinguished career as a physicist. Before joining the faculty at Texas Tech University in 1978, he was a postdoctoral fellow at Battelle in Columbus, a researcher and instructor at the Swiss Federal Institute of Technology in Lausanne, and an assistant professor at the University of Illinois in Urbana. He is now Chair of the Physics Department at Texas Tech, and has been a recipient of the President's Excellence in Teaching Award. It is particularly impressive that, despite the heavy demands associated with being a department chair, he has still managed to maintain an active research program in which he, his students, and collaborators have sixteen refereed publications in the past six years.

We Also Hear That ...

● **Charles H. Church** (BS '50) retired from the U. S. Army Research office in Chapel Hill, NC on 30 March 1997. He was planning on moving to Savanna, GA.

● **Harry F. Dreste** (BS '51) of Kirkwood, MO writes "have been enjoying retirement for several years. Keep busy working around home and with hobbies, model railroads, and old Studebaker cars. Member of two old car clubs and volunteer worker at Veterans Hospital. Cancer treatment past few years going OK."

● **William P. Dixon** (BS '54, MS '57) of Tullahoma, TN, reports that he retired 3 years ago and is now in good health and spirits. We are sorry to hear that he lost his wife Leah near the time of his retirement.

● **John L. McDaniels** (BS '60) retired as Professor of Mathematics in June, 1996, from Lewis and Clark Community College, where he had taught mathematics and coordinated the engineering transfer program.

● **Robert C. Pickett** (BS '61, MS '68) spent 1996-1997 on sabbatical from Bemidji State University. During his sabbatical he worked on a computer instrumentation project.

● **Daniel N. Payton, III** (BS '62, MS '64, Ph.D '66) of Albuquerque, NM, writes "From being an independent technology management consultant, I took over as president and CEO of New Mexico Technet, a non-profit internet access/data provider and backbone network for the State of New Mexico."

● **Robert Hufft M.D.** (MS '64) of Rogersville, MO has completed 21 years of private practice in orthopedic surgery in Springfield, MO. He practices general orthopedics with an emphasis on joint replacement and spinal surgery.

● **Martin G. Seitz** (BS '66) of Silver Spring, MD, is currently working with the Department of Energy in Washington, DC.

● **Richard D. Thom** (BS '67) of Santa Barbara, CA, is a new Program Executive for Technology at Hughes Santa Barbara

Research center, responsible for capture and management of contracts to develop advanced infrared systems components. Richard and his wife have made their home in Santa Barbara since 1972. Their daughter graduated from UC Davis and their son attends UC Santa Barbara – in fields far removed from physics!

● **Gary K. Woodward** (BS '69, MS '73) of Kokomo, IN, was recently promoted at General Motors Corporation to Advanced Project Engineer.

● **Hugh Holt** (BS '70) writes "my physics degree put me in a good position to work on airborne radar over the past twenty years or so. I've been involved in the design, development, and test (including flight test) of a number of radars during that time. One of the most familiar with the public has been the Joint STARS radar for the Air Force."

● **Charles R. Wickizer** (BS '72) lives in Cambridge, MA. He tells us "I sold my second startup software company to a small publicly held firm in Sunnyvale, CA. I am now in my third year at the Episcopal Divinity School in Cambridge, MA, studying to become an ordained priest. I won second prize in the Boston Theological Institute for an essay on Science and Religion. My wife, Joan and I have two daughters, ages 11 and 13, and a chocolate Labrador retriever.

● **Brian G. Millburn** (BS '75) retired as Lt. Col. from US Air force after 20 years of service. He moved to Colorado Springs where he enjoys working on challenging analytic projects for ANSER Corp. and raising 3 sons ages 17, 15, and 13.

● **Bradley A. Brown** (BS '80) of Hermann, MO, writes he "was laid off in 1990 and couldn't find a job and was forced into starting my own business -- analyzing utility bills for commercial and industrial companies. It was the best thing that could have happened! Currently I am my own boss and business is doing real well."

● **Larry Long** (MS '81, PhD '85) was on sabbatical research leave from Pittsburg State University for the 1996-1997 academic year. During his sabbatical, he conducted research on thin film batteries for Eagle Picher Technologies in Joplin, MO.

● **Mike Muehleemann** (BS '82, MS '85) of East Syracuse, NY, who is currently President of Illumination Technologies, tells us he would like to hear from Robert Cheney, Pat Garey, or Steve Yallaly. Mike can be reached at it@ntcnet.com.

● **Suzanna Jo Edwards** (BS '90) lives with her husband Kevin in Chesterfield, MO. She says "I'm a mom to three wonderful daughters! Life is great!"

● **Jeffrey Paul Schroeder** (BS '95) lives in Aurora, CO. He tells us that he had a great time at UMR recruiting for Hughes at the 1997 spring Career Fair, and that his life is considerably more exciting since the birth of his son Alex on January 31, 1997.

● **Shawn Kathmann** (PhD '98) has accepted a post-doctoral position at Battelle Pacific Northwest Laboratories. He left Rolla just a few weeks ago after receiving his doctorate for molecular modeling of sulphuric acid in water clusters.

If you wish to get in touch with any of these alumni, or any others, please contact the Physics Department at (573) 341-4781 or at physics@umr.edu. We can generally give you current phone numbers, along with postal and e-mail addresses. We would be grateful if you would take the time to fill out and return the alumni information form on both sides of the last page of this Newsletter.

Student Notes

Three undergraduate students, **Pat Berryhill**, **Josh Gary**, and **Brad White**, were invited to present their Advanced Laboratory research at the 1997 Midwest Student Conference of the American Nuclear Society. Their research was on the optical properties of F-centers in alkali-halide crystals.

Mike Pinkerton presented a talk on his Advanced Lab scanning tunneling microscope at the American Association of Physics Teachers 1997 summer meeting in Denver, Colorado. Mike was the only undergraduate to present a paper in the undergraduate research session; all of the other presentations were made by professors.

All physics majors who graduated in May, 1997, graduated cum laude or better. Three students, **Hal Burch**, **Shella Keilholz**, and **Kevin Moll**, graduated summa cum laude and three more, **Pat Berryhill**, **Josh Gary**, and **Brad White**, graduated magna cum laude.

In an effort not to be outdone by the graduating seniors, seven of the fifteen physics freshmen who came in the fall of 1997 got perfect grades, 4.0, their first semester. Several others got only one B. The Physics Department has been able to attract truly outstanding students.

Two undergraduates, **James Dent** and **Chris Maloney**, carried out research under the supervision of **Don Madison**. **James** and **Chris** had their research published in the *Physical Review* and the *Journal of Physics*. The results of their research were presented at conferences in Washington, D.C.; Vienna, Austria; and Argonne National Laboratory.

Ryan Feeler had two papers published describing his undergraduate research. The papers were published in *The Physical Review* and *Nuclear Instruments and Methods*. **Ryan** did his research under the supervision of Prof. **Ron Olson**.

Physics major **Mike Pinkerton** from Kennedale, Texas, was appointed as one of two marshals for the College of Arts and Science at the 1997 fall commencement. Marshall appointments are based on highest student grade point at graduation. Mike graduated summa cum laude.

The first "perfect" SAT student at UMR is a current physics freshman. **Sean McKinney** got a 1600 on the SAT exam as a high school junior and came to UMR last August as a physics freshman. Sean is only the third "perfect" student (the other two had perfect ACT scores) to attend UMR. All three have been physics majors. We have attracted one "perfect" student every other year since 1993!

Shella Keilholz received a three-year, \$54,000 Department of Defense Fellowship to attend graduate school at the University of Virginia, where she plans to pursue a Ph.D. in medical physics.

Three undergraduate students, **Ryan Feeler**, **Seth Root** and **Kari Wojtkowski**, spent their summer doing research under the supervision of Prof. **Ron Olson**. All three students had their research supported by a grant from the Department of Energy.

Graduate Awarded National Fellowship

Shella Keilholz (BS '97) of Frankenstein, MO, was awarded a three-year Department of Defense Fellowship last spring shortly before her graduation from UMR last May. The fellowship includes \$54,000 in stipends plus tuition. Shella began graduate studies at the University of Virginia last fall where she plans to pursue a PhD in medical physics.



Shella Keilholz

Keilholz is one of 90 new students to receive the NDSEG Fellowship from the Department of Defense National Defense and Engineering Graduate Fellowship Program. Fellowships are awarded to "individuals who have

demonstrated ability and special aptitude for advanced training in science and engineering." The program is sponsored by the U.S. Army, Navy and Air Force.

The Department of Defense will pay Keilholz's tuition and fees (excluding room and board) and will provide the following stipends: \$17,000 for 1997-98; \$18,000 for 1998-99; and \$19,000 for 1999-2000.

Shella was the first perfect (ACT of 36) student to come to UMR. She was one of three students who created a scanning tunneling microscope (STM) using \$70 in expenditures and ordinary laboratory equipment. A scanning tunneling microscope takes pictures of individual atoms that make up the surface of a solid. Commercial versions cost thousands of dollars. Among their many uses, STMs are used to study bacteria, semi-conductors and computer chips.

P H O N A T H O N

1 9 9 8

March 15-18

Join in the
Full Circle
Campaign.
Make a pledge
for progress!

Versatile Research/Teaching Equipment Donated To Department

Thanks to the efforts of **Norman Pond** (BS '59), Intevac Inc. has donated to UMR's Physics Department a scanning electron microscope with image analysis and an ultrahigh vacuum chamber and pumping system. Norman is Chairman, President, and CEO of Intevac. During his Homecoming visit to the campus he mentioned that Intevac had some spare equipment which might be useful to us. Soon thereafter, physics Profs. **Ed Hale** and **Dan Waddill** visited Intevac in Santa Clara, CA. During their tour of these impressive facilities, the microscope and vacuum system were identified as items the company would like to donate to the Physics Department. The instruments have recently arrived at UMR.

The ultra high vacuum (UHV) system will be used by Waddill to assist in his investigations of nanoscale materials (see related Newsletter article). This research involves fundamental measurements of new magnetic materials that are critical to the burgeoning information storage industry. The donated equipment will be used in the construction of a unique device for the characterization of magnetic structure at the atomic level.

The scanning electron microscope gives the department direct access to one of the most powerful and useful instruments in the study and characterization of microstructure, size and composition of many types of materials. This information is crucial in this age of ever expanding uses of new and exotic materials in devices that grow smaller every day. The first use of the microscope will be in the department's Cloud and Aerosol Sciences Laboratory (CASL) to characterize particles emitted from rocket and aircraft exhaust (see related Newsletter article).

The scanning electron microscope works by irradiating a sample with a finely focused beam of electrons. This in turn produces secondary electrons, back scattered electrons, and characteristic x-rays from the sample. The signals from the electrons are used to form images of the sample on a microscopic scale. The donated microscope is equipped with an energy dispersive x-ray detector which collects the x-rays emitted from the sample following electron irradiation. Analysis of these x-rays reveals the structural and compositional makeup of the sample material.

The Physics Department has plans to use this unique resource for both teaching and for graduate and undergraduate research projects. In addition, the capabilities of this microscope will enliven the teaching of various aspects of solid state and materials physics, and will serve to enrich the learning experiences of our students for many years to come.

Thanks, Norman!

Wilemski Named Director of UMR's CASL

Dr. **Gerald Wilemski** has been named Director of the Cloud and Aerosol Sciences Laboratory at the



Gerry Wilemski

in the department.

Wilemski replaces **John Carstens**, who retired last September after being CASL's Director since 1984. The Laboratory has nine faculty members and nine research assistants. "Gerry's extensive and diverse research background will be a great asset to our campus," says UMR Chancellor **John T. Park**. "His breadth of research experience includes work in academia, industry and government laboratories. I am extremely pleased that UMR has Gerry as CASL's director."

"There is a critical nucleus of researchers here who work in fields closely related to my own areas of interest," observes Wilemski. "It is a major benefit to have opportunities to interact – both formally and informally – with colleagues. Colleagues serve as important sources of information and can help improve the quality of each other's research."

Wilemski's research interests

include thermodynamics and statistical mechanics of nucleation, aerosols, polymers, colloids and electrochemical systems. At UMR, he will concentrate on fundamental aerosol research – an interdisciplinary field that is rapidly expanding in universities throughout the United States. "Aerosol research is increasing around the world as scientists examine the effects of atmospheric particles on air pollution, ozone depletion and global warming," Wilemski says. "The recognition of the importance of aerosol phenomena is growing."

In March 1998, Wilemski will be a part of an international team of scientists working at the National Institute of Standards and Technology in Maryland to measure small angle neutron scattering from nanometer-sized aerosol particles. By interpreting the neutron scattering patterns, the team hopes to determine the structure and composition of these very small aerosol particles.

Wilemski received his Ph.D. in theoretical chemistry from Yale University in 1972, following his undergraduate years at Canisius College in Buffalo, NY. After leaving Yale, he was a visiting assistant professor and research associate for three years at Dartmouth College in Hanover, NH, and a principal research scientist at Physical Sciences Inc. in Andover, MA, for sixteen years. Before coming to UMR, Wilemski was a research scientist at Lawrence Livermore National Laboratory in California.

First Class Senior Physics Class

All physics majors who graduated this past May graduated cum laude or better. Three were summa cum laude and three were magna cum laude. We believe this is the finest record of a senior class in physics at MSM and UMR and most likely of any department's class of comparable size or greater at MSM and UMR.

Fourth Annual Laird D. Schearer Graduate Research Prize

The Laird D. Schearer Graduate Research Prize competition has proven to be an appropriate, ongoing tribute to Laird D. Schearer, late Curator's Professor of Physics and active promoter of graduate research. Gifts from alumni, friends and the Schearer family have endowed and increased the Laird D. Schearer Fund, established to provide annual prizes for the best research conducted by a UMR physics graduate students.

Our graduate students gain valuable experience in the Prize process by documenting their research accomplishments to the Prize committee and presenting their work to a general audience. A faculty committee selected three graduate finalists to describe their research at a departmental colloquium

held in late November. This year's finalists were **Heider Ereifej** in experimental laser physics whose entry was titled "Unlimited sensitivity in trace element detection" (supervised by Profs. **Greg Story** and **John Schmitt**), **Kevin Cornelius** in theoretical atomic physics with "Collision dynamics for $H^+ + H(n=25)$ using CTMC [Classical Trajectory Monte Carlo]" (supervised by Prof. **Ron Olson**), and **Mevlut Karabulut** in experimental solid state physics with "Structural properties of iron phosphate glasses" (supervised by Prof. **Dan Waddill**). Following the colloquium presentations, the committee awarded first place honors to Mr. Ereifej, who has written a personal profile that appears below.

From the Schearer Prize Winner

My name is **Heider N. Ereifej**, and I am honored to have received the First Place Award in the 1997 Schearer Prize competition.



Heider Ereifej

I was born on Oct 5, 1970, in Seged, Hungary, where my father was a university student. My family later moved back to Ajloun, my father's small hometown in Jordan. There I received my elementary and high school education. By the time I was a sophomore in high school my fascination with physics was dominating all my plans for the future. When I finished high school in 1988, I already had decided that it is going to be physics for which I lived.

In July 1988, I was admitted to the physics department at Yarmouk University in Jordan, and I was so happy. College was the best time of my life. I learned a lot and made a lot of friends. The only problem was that it went so fast, and it was time to graduate before I realized it. In May, 1992, I was awarded a B.Sc. in physics. I then entered the masters program at the same university.

While I was working on my M.Sc. Degree, I was trying to get admitted to a good school in the USA. I defended my Master's thesis in October 1994, and graduated from the school in which I had spent six years of my life. Meanwhile I was accepted to a few colleges here in the States. After careful considerations, I decided that UMR's physics department was the place to be. I arrived in Rolla on Jan 11, 1995.

At first I worked with Prof. **Michael Schulz** in the field of atomic ion scattering. After four months, I felt that it was not the right field for me. During that time I heard about the laser and atomic lab that was being formed by newly-hired Prof. **Greg Story**. I decided to get involved in it, and was working with Prof. Story by the end of 1995.

At first it was very hard for me. I had no previous experience with lasers, and it took some time for me to get used to all those laser beams that could blind you if you are not careful. But after I broke a few mirrors here and there, I got used to the idea of working with lasers, and it became obvious to me that I really like lasers.

So far I have worked on two projects from which at least two papers will be submitted for publication. We are currently working on a new short-pulse laser system.

From Alumnus Hugh Holt (BS '70) ...

My UMR physics degree put me in a good position to work on airborne radar over the past



Hugh Holt

twenty years or so. After a significant stint at RCA, I have now worked for many years at Northrop-Grumman in Norwalk, CT. I've been involved in the design, development and testing (including flight testing) of a number of radars during that time. They have tended to be airborne, high resolution surveillance and imaging radars ("Synthetic Aperture Radars"). One of the most familiar with the public perhaps has been the Joint STARS radar for the US Air Force.

My physics degree has been helpful in work ranging from antennas to signal processing, and related technical areas such as inertial navigation systems and GPS. My UMR optics, E&M, mechanics and mathematics have been particularly useful. More generally, I'd say that the overall discipline of approaching a problem from the "top down" (i.e., starting with the most general formulation and then working down to the specific while keeping in mind all along what assumptions and limitations one is making as one goes through the process) has helped me keep things in context. So I'd say my four years of physics have been helpful.

My wife Florence and I live in West Redding, CT. It's a lovely town surrounded by woods. I've been away a lot lately — one of the less pleasant aspects of my work has been the amount of travel required. No big trips — mostly same-day trips to Washington DC or Baltimore (NY to DC shuttle), occasionally one to three day trips elsewhere in the country. One would think that with more email, fax and video conferencing these days, travel would decrease, but it doesn't seem to be the case.

I did go back to graduate school (UC Berkeley) in the '74 to '76 time frame to study electrical engineering. I received an MS in electrical engineering and computer science. I found I needed more EE flavor in the work I was doing and, at the same time, felt I needed some amount of retraining after having spent two years as a draftee in the army. Six weeks after getting my BS in physics, I got drafted. Even with my physics degree, I was "selected" for the infantry! But I survived and had some once-in-a-lifetime (I hope!) experiences.

I'd love to hear from old friends. You can e-mail me at HoltHu@ct.essd-northgrum.com. I'm a little homesick for those days at UMR. It really was nice part of my life.

Chipping Away at Atoms with Lasers

Most of us learned in high school that an atom is the smallest form of matter. Atoms make up everything from our bodies to air and water molecules. An atom, we learned, cannot be divided and still retain its chemical identity. We also learned that atoms consist of protons and neutrons and electrons in just such a number as to compose an element. Armed with this information, hopefully we all made it through the science test on that topic.

In UMR's Physics Department, Prof. **Greg Story** is taking knowledge gained by researching atoms to exciting new levels. Story is curious about the structure of atoms and uses laser technology to discover the make-up of various atoms. "What we're interested in is the structure inside something so small you can't see it," Story said.

Inside his laboratory at UMR, Story's research appears as a fascinating laser-light show. On top of a large, stainless steel table is a system of lasers generated from one intense, short-pulse laser. Using mirrors, prisms, magnifying glasses and special liquids in tubes, Story and his students are able to convert a single laser into a



Greg Story in his Laser Lab

number of lasers whose color can be changed. A recent \$280K grant from the National Science Foundation has helped to create this laser wizardry.

It is beautiful, but the process is complex. By using the energy from the laser, electrons can be chipped away from atoms and then collected. By examining the electrons thus liberated, it is possible to "piece together" the structure of the atom. "What you have to do is hit the atom with something and see what comes out," explains Story.

By using different photon energies and measuring how the electrons come off, Story says it is possible to gain a great deal of information about the make-up of the atom. Information about the structure of atoms could help give astronomers a better idea of what types of matter are in distant galaxies, and what elements make up the galaxies. This research could also help scientists develop better, more efficient methods of nuclear fusion.

Although he has already published more than 23 research papers, Story is not a mad scientist who works in seclusion late at night in his lab. Far from it. In fact, the professor said he encourages students to join in his research. He currently has three students working with him on a regular basis. Undergraduates **Jeremy Maddox** and **Joshua Zirbel** and graduate student **Heider Ereifej** learn the art of research while assisting him.

Story said he likes to see students participate in the laboratory work. "We are really big on getting undergraduates involved in research," Dr. Story said. "You have to be more creative when you're in the lab."

Student with Perfect SAT is a First for UMR

Last fall, current physics major **Sean McKinney** of Springfield, MO, became the first student with a perfect SAT score to attend UMR.

McKinney, a graduate of Glendale High School, took the SAT in June 1996, the summer before his senior year, and scored a perfect 1600.

"I anticipated a high score in math, but I didn't expect an 800 in English," McKinney says.

Of the 2.47 million students who took the SAT last year, 545 of them scored 1600, according to the Educational Testing Service of Princeton, N.J., which administers the test. A score of about 1,000 is the average.

McKinney is enrolled in UMR's five-year Master Student Fellowship Program, which will allow him to earn a master's degree in five years.

He plans to pursue a Ph.D. degree and

become a physics professor.

"I like searching for underlying truths and finding fundamental answers," McKinney says. "I like to use mathematics to find answers, to find out what is at the root of things."

Sean started early on his undergraduate research experiences at UMR. Since last summer, he has been working in the thin-film analysis laboratory in the Physics Department with Prof. **Dan Waddill**.

Where There's a WILL, There's a Way

Do you want to help shape the future of UMR even after your own lifetime? One way to do so is through an outright *bequest*, a charitable gift that is exempt from federal estate tax. Planned giving may also be done through *wills*. Another way is through a *charitable remainder* trust, which can give your beneficiary a lifetime income while the principal is held for the institution(s) of your choice.

Other similar trusts can also be established depending on your specific goals in maximizing personal needs, minimizing after-tax costs, and making charitable contributions. One example is the very generous deferred gift of **Norman** and

Natalie Pond described on the front page of this Newsletter.

General bequests and a variety of other donations can be arranged through **Sandra Ogrosky** in UMR's Development Office. She can discuss with you the numerous options for planned giving or can send you brochures with detailed information. Contact Sandra through the Physics Department at (573) 341-4781, e-mail her at sogrosky@umr.edu or call her directly at (573) 341-6088. This type of gift goes on giving long into the future, continuing to bear the imprint of the giver and attesting to his or her generosity.

UMR Researchers Study Aircraft and Space Shuttle Exhausts Up Close

No head room. No leg room. No reclining seats. No magazines. No peanuts. No flight attendants. No temperature control. Turbulence, however, can be expected.

And all flights end at the same airport where they begin. Such are the flights that UMR's **Don Hagen** and other researchers from UMR's Cloud and Aerosol Sciences Laboratory (CASL) must endure in order to study aircraft exhaust emissions in the North Atlantic Flight Corridor.

The UMR researchers took advantage of ideal weather conditions in the skies over the North Atlantic last fall to study how aircraft exhaust emissions can build up in heavily traveled airways. Their study should give the scientific community a better picture of how aircraft emissions effect the upper atmosphere.

The UMR team – part of a consortium of scientists from the United States and Europe – say that the scientific flight into the heavily traveled “North Atlantic Flight Corridor” took advantage of an occasional atmospheric phenomenon called an anticyclone to study emission buildups.

Anticyclones are ideal for aircraft exhaust studies because the air recirculates several days over the same area, during which time the contributions from aircraft emissions build. Whenever an anticyclone settles over air traffic routes, it provides a snapshot view of the cumulative effect of aircraft exhaust.

“This international research project requires precise timing and coordination between a dozen team members, but the effort has proven worthwhile,” explains



Hagen. “All of the team members reported an increase in emissions in the anticyclone. If enough data is taken by all of the scientists, we can begin to get a picture of what is happening in our atmosphere as a result of aircraft emissions.”

UMR fielded a team of four CASL researchers at Shannon Airport, Ireland, during the eight-week study. They analyzed airborne particles aboard a specially equipped aircraft operated by the German aerospace research program. UMR's researchers fed the samples through a complex system of valves, hoses and a condensation particle counter to determine the size, number and concentration of sub-micron particles.

Particles are produced when gases and water vapor from the exhaust mix, and these particles provide surfaces upon which chemical reactions can occur. These reactions produce new materials that can pollute the atmosphere.

The UMR team also conducted similar tests of space shuttle exhaust during two launches last year to see how the exhaust affected the ozone layer. The Rolla representatives stayed on the ground preparing and running equipment, while exhaust samples were gathered by an Air Force WB57 that performed figure-eights



Top photo: Air Force shuttle exhaust collector

Bottom photo: Don Hagen at work in his mobile lab

through the shuttle's plume about 20 minutes after takeoff. The NASA-operated jet transmitted data during flight and brought samples and the equipment back to the Cape, where Hagen and co-workers began to evaluate the data. The Air Force and NASA want answers to questions about the local environmental impact of rocket exhaust. The UMR researchers' tests are the most comprehensive ones conducted on the shuttle's plume to date.

Articles on the space shuttle studies by Hagen and his co-workers appeared in the *Wall Street Journal*, *New York Times*, *USA Today*, *St. Louis Post-Dispatch*, and the *Orlando Sentinel*.

Faculty Notes

Don Sparlin and **Allan Pringle** supervised the 1997 Physics Day at the World's of Fun theme park near Kansas City. Their fourth annual appearance resulted in an attendance of over 1800 science students who explored the physics of theme park rides. More than 30 science teachers presented their favorite portable science demonstrations, and ten Hot Wheels Roller Coasters were entered in the "build your own coaster" competition.

In early January **Ed Hale** attended the annual winter meeting of the American Association of Physics Teachers in New Orleans. He enjoyed talking with two MSM/UMR physics alums, **Robert Fuller** (BS '57) and **Richard Shields** (PhD '73) who were also attending.

Ron Bieniek, a.k.a. *VectorMan* in charge of the department's Engineering Physics course, and the lovely **Louise Morgan**, Marketing Director of public radio KUMR, were married in the circle of UMR's Stonehenge on the Winter Solstice (Dec 21) 1997. The weather was evocative of that other Stonehenge in Britain – a near-freezing drizzle on the darkest day of the year. If you would like to see images of the occasion, Ron says to check out his personal Web page at <http://www.umn.edu/~bieniek>.

Bob DuBois was made a Fellow of the American Physical Society at the May, 1997, meeting of the Division of Atomic, Molecular, and Optical Physics. He was so honored for his "contributions to heavy particle collision physics, especially the innovative use of coincidence techniques to elucidate the influence of projectile electrons on impact ionization and separate target and projectile ionization." Bob also recently co-authored a book titled *Electron Emission in Heavy Ion-Atom Collisions*, published by Springer Verlag (Berlin).

Ibrahim Adawi retired last summer after 30 years on the physics faculty. A search for his replacement is currently underway.

In May, 1997, **Ron Olson** had four of his recent *Physical Review Letters* cited in *Physics News* in 1996, a supplement to *APS News*. One of these citations was the *PRL* co-authored by UMR undergraduate **Joshua Gary**.

Gerry Wilemski, our newest faculty member, gave an invited talk on his research on neutron scattering from aerosols at the Gordon Research conference on the Physics and Chemistry of Liquids.

Ed Hale was one of three physicists on a review team set up by the Arkansas Department of Education to review all that state's college physics departments. He was also the department's representative on the Dean's Search Committee which selected **Russell Buhite** as the new Dean of the College of Arts and Science. **Buhite** came to UMR last summer after serving eight years as Head of the History Department at the University of Tennessee, before which he was Chair of the History Department at the University of Oklahoma and Interim Dean of its College of Arts and Sciences.

The Physics Department had a prominent television role when Springfield's KY3 broadcasted "Celebrate the Ozarks" live from UMR. Irrepressible **Don Sparlin** danced with the female anchor from the station as part of his performance duties with the World's Finest Rolla German Band (although he generally keeps his departmental affiliation a secret when dressed in lederhosen). **Greg Story** showed off the gee whiz aspects of his laser research lab (including laser lighting) when it was featured on the same telecast.

John Carstens retired last summer after 29 years on the physics faculty at UMR. For the last 13 years he was director of the Cloud and Aerosol Sciences Laboratory.

FRONTIERS IN PHYSICS

During 1997, twenty-one speakers from other institutions visited the Physics Department to present colloquia in the *Frontiers of Physics* series. This included Prof. James Kaler, who delivered the Harlow Shapley Lecture on planetary nebula described in a separate article of this Newsletter.

Astronaut **Tom Akers** probably holds the record for the longest distance traveled for a UMR physics colloquium, since he launched into a Space Shuttle Mission simply to gather material for his presentation *NASA Missions and the MIR Space Station*. But to give his seminar, he merely had to walk from his UMR Air Force ROTC office to the Physics Department. He talked about his shuttle missions in general, and more specifically about his time aboard the MIR space station. Needless to say, this talk was presented to a packed lecture hall with many students attending from outside the physics department.

The Department enjoyed hearing **Gerry Wilemski** of Lawrence Livermore National Lab describe his *Aerosol SANS* (small angle neutron scattering) experiments which he uses to characterize macroscopically small particles in the atmosphere, and to probe droplet/vapor interfaces. These, in turns out, have considerable impact on nucleation, droplet growth, and heterogeneous chemistry, and are important phenomena in a variety of industrial and atmospheric processes. As you will read elsewhere in this newsletter, Gerry was subsequently selected to replace John Carstens when he retired as Director of the Cloud and Aerosol Sciences Laboratory.

David Crandall returned to Rolla to speak on *Inertial Confinement Fusion*. Over 25 years ago, he was a post-doctoral fellow in the ion-accelerator laboratory of now-Chancellor **John Park**. Dave is now Director of the Inertial Fusion/National Ignition Facility Project of the US Department of Energy. In his presentation, he described the new facility being constructed at the Lawrence Livermore National Laboratory. When completed, the facility will direct 196 intense laser beams on small gold capsules containing hydrogen and deuterium to induce a fusion reaction. This



Dave Crandall

talk was especially interesting for the graduate students since it provided a high-level example of how their research efforts, when applied in a broad team effort, may ultimately contribute to scientific advances affecting the general public. During his visit, Dave renewed acquaintances with many old friends, and had a chance to visit the current manifestation of the accelerator lab in the renovated physics basement.

We were also fortunate to have alumnus **Charles Myles** (BS '69) as our 1997 Homecoming Colloquium speaker. Charley is Chair of the Physics Department at Texas Tech University. While here, he spoke on his recent research in *Molecular Dynamics: A Tool for Probing the Defect Properties of Semiconductors*.

Lee Grodzins of the Massachusetts Institute of Technology delivered a particularly interesting and timely seminar. For many years, Dr. Grodzins was an advisor to the FAA on bomb and contraband detection at airports or border crossings. He presented a very interesting lecture on this topic titled *The Physics of Airport Security*. Grodzins also runs MIT's undergraduate physics "advanced lab" courses. The department's corresponding instructor, Prof. **Bob DuBois**, found it very interesting to compare the type of experiments that are performed at MIT with those that our students select.

In late spring, a special colloquium is dedicated to the **Fuller Undergraduate Research Competition**, where the best undergraduate projects are presented by the students who conducted the work. These presentations are quite polished, and employ fine graphics and electronic projection. First place was awarded to **Shella Keilholz** who spoke about the *Design and Construction of a Scanning Tunneling Microscope*, an Advanced Lab project undertaken with **Mike Pinkerton** and **Kevin Moll**. There was a tie for second place honors between **Brad White's** talk on *An Investigation of the Optical Properties of F-Centers in Alkali Halide Crystals* and **Pat Berryhill's** presentation of a *Study of the Normal Mode Vibrations of Model Low Temperature Water Clusters*. The F-Center work was performed in the Advanced Lab in conjunction with **Josh Gary**, while the water cluster research was performed under the direction of Prof. **Barbara Hale**. These presentations prove to be valuable learning experiences for the undergraduates. The overall quality often exceeds that of speakers who have many years of additional experience.

Nanostructure in Computer Memory

New atomic-scale materials will allow computer manufacturers to pack more computer memory into ever-smaller spaces and at less cost. That's according to Prof. **Dan Waddill** who is studying the new materials. These materials, often called "nanoscale" materials because of their extremely small size, will result in a 20- to 30-fold increase in a computer's storage capacity over the next several years. Computer manufacturers are beginning to use the newly created atomic-scale materials for data storage and retrieval in computer hard drives and disks.

"Prices of computers keep coming down due to enhancements in materials processing," says Waddill. "We have had a real takeoff in our ability to fabricate materials and structures that we weren't capable of doing until very recently. This technology is showing up in your day-to-day life, whether you realize it or not."

These materials are composed of tiny superstructures made of a combination of layers of different metals or substances three to ten atoms thick. "They are very small, and it's only recently have we been able to grow these materials in a reproducible fashion," Waddill says.

Waddill hopes to learn why atomic-scale layers produce different properties than the same combination of metals or substances in bulk form. Some nanoscale materials, such as layered metals, are stronger than metals produced in the tradi-

tional way.

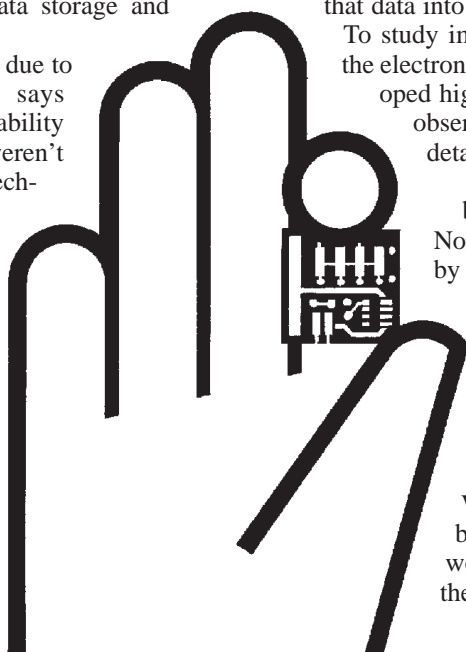
"The exciting thing about these layered structures is that they exhibit a huge enhancement in magneto-resistance," Waddill explains. Data storage potentially increases by 20 to 30 times in computers and tape recorders with the improved magneto-resistance these materials bring. A small metal "needle" sees each magneto-resistance variation as a piece of data and translates that data into useable information.

To study improved magneto-resistance, Waddill excites the electrons of these tiny materials with a recently developed high powered X-ray beam. This allows him to observe the materials distribution, as well as the detailed structure on an atomic scale.

This research will be substantially aided by the ultra high vacuum system that alumnus Norman Pond (BS '59) arranged to be donated by Intevac, Inc., reported elsewhere in this Newsletter.

Although researchers know how to create these new materials with high magneto-resistance, much remains unknown about them.

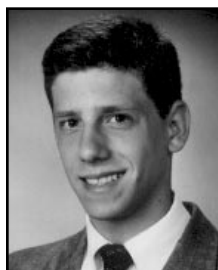
"What we don't really understand is why these materials work the way they do," Waddill says. "Understanding the physics behind the magnetic properties is where I would like to come in. If we understand how they work, chances are we'll be able to make better materials than we do now."



Two Undergraduates Are National Research Winners

Two physics majors, **Dan Chitwood** and **Chris Maloney**, were winners this year in the annual undergraduate research competition sponsored by the Division of Atomic, Molecular and Optical Physics (DAMOP) of the American Physical Society. Both Dan and Chris do research under the supervision of Prof. **Don Madison**.

An international committee of physicists selected the five winning undergraduate from across the nation. All expenses of each winner will be paid to attend the annual DAMOP meeting this May in Santa Fe, NM, where they will be honored at a special ceremony. They have also been invited to present talks about their research.



Dan Chitwood



Chris Maloney

Dan examined competing ionization processes in electron-atom collisions. In one ionization process, the incident electron knocks a second electron out of the atom. In a competing process known as autoionization, the incident electron excites an atomic electron into an unstable

state. An electron is ejected when the atom decays back to its ground state. Quantum mechanics predicts an interference pattern from the competing decay processes. Dan has calculated its expected form and will compare his predictions with experimental measurements being performed at the University of Kentucky.

Chris is studying electron impact excitation of laser-excited argon. His earlier work on ground-state argon will soon be published in the *Journal of Physics B*. Experiments are now underway at the University of Wisconsin on excited atoms like those studied by Chris. At Santa Fe, he will compare the predictions of his calculations with the new experimental data.