Powerful, mysterious cosmic explosion appears in nine-year-old 'orphan' data

UAH graduate student Yuki Kaneko

It might have been one of the most powerful cosmic explosions since the Big Bang, but the evidence that it happened languished unexamined for more than nine years.

Then it was almost dismissed as flawed by the scientists who found it.

Now resurrected and verified, the evidence of a unique and powerful gamma ray burst that arrived at Earth in October 1994 might force astrophysicists to rewrite theories explaining these enigmatic flashes of radiation from the furthest edges of the universe.

'I was, like, devoted to this, every day.'
— Yuki Kaneko

When the data arrived at UAH, however, graduate physics student Yuki Kaneko spent more than a month trying to prove that it wasn't real.

"I thought it was kind of artificial," she explained. "I had never seen that kind of burst before. This hadn't been observed and it hadn't been predicted."

What made this burst unique was not only the power of the radiation, but also the timing and duration of the highest-energy portion of the burst.

A graph of the energy output from a typical gamma ray burst might look like one of the Himalayas, with a quick buildup of energy and a sharp peak, which decays slower than it built up. The highest energy peak (usually in the hundreds of thousands of electron volts) arrives early and might last a few tens of seconds before the burst fades into weaker gamma rays, X-rays and a lower-energy afterglow.

(Gamma rays are at the very top end of the electro-magnetic energy spectrum. Each gamma ray photon has thousands of times as much energy as the most powerful X-rays.)

The data from the Oct. 17, 1994, burst didn't fit the profile. First, the highest energy in the burst peaked at more than 200 million electron volts

Continued on page 10.

UAH's Mike Newchurch explains ozone destruction during a press conference at the National Press Club in Washington, DC.

Destruction of ozone layer is slowing after worldwide ban on CFC release

The rate at which ozone is being destroyed in the upper stratosphere is slowing, as is the rate at which ozone-destroying chlorine in that layer of the atmosphere is increasing — the first clear evidence that a worldwide reduction in CFC pollution is having the desired effect.

"This is the beginning of a recovery of the ozone layer," said Professor Michael Newchurch, the UAH researcher who led the ozone trend-analysis research team. "We had a monumental problem of global scale that we have started to solve."

Using data from three NASA satellites and three international ground stations the team found that ozone depletion in the upper stratosphere — the layer of the atmosphere between 35 and 45 kilometers above the ground — has slowed since 1997.

The results of this work were published in the American Geophysical Union's *Journal of Geophysical Research.*

A damaging pollutant in the air near the ground, ozone in the stratosphere shields Earth from harmful ultraviolet solar radiation. Almost 30 years ago scientists Mario Molina, F. Sherwood Rowland and Paul Crutzen showed that chlorine released into the stratosphere from chlorofluorocarbons (CFCs) — chemicals used as refrigerants and aerosol propellants — was destroying the protective ozone layer. This news led to the Montreal Protocol, an international ban on CFC-based products.

"There have been several amendments to that ban, each of which tightened restrictions on CFCs and other halogenated hydrocarbons," said Newchurch, an associate professor of atmospheric science at UAH. "We are now at the point where the restrictions are tight enough to result in a measured turnaround of CFC amounts at the surface. Now we can say that what we're doing is working and we should continue the ban.

"We're not gaining ozone, we're just losing it less quickly. But the trend line is flattening. And the increase of chlorine in that layer of the stratosphere has slowed significantly, so we should start to see some ozone improvement in the coming years."

The slowing of ozone destruction is seen only in the upper stratosphere, where ozone depletion is due primarily to chlorine pollution, Newchurch said. "But

Continued on page 4

The Dean's Message

Dr. Jack Fix

Wilson Hall has been the home of UAH science activities for almost 40 years. Nearly every science graduate during that time took at least one class or lab in Wilson Hall.

Now construction of a new campus building, the Transportation and Applied Sciences Building (TASB), will soon move the College of Science out of Wilson Hall.

The majority of TASB funding will come from federal sources. U.S. Sen. Richard Shelby has already arranged the first installment of federal funding and plans to provide the balance over the next year or two.

The cost to design, build and equip the building is projected to be $50 million. The largest teaching and research building at UAH, it may be built on John Wright Drive near Von Braun Research Hall. A mix of research centers (particularly those related to transportation), research labs, incubator space, offices, classrooms and teaching labs will occupy the new TASB.

The relocation of science activities from Wilson Hall to the TASB will include moving the Department of Biological Sciences, along with physics and chemistry teaching labs.

Wilson Hall has served us well, but we desperately need to replace Wilson Hall facilities with modern labs for teaching and research.

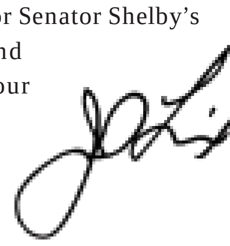
Another high priority for the TASB is the relocation of the Computer Science Department from Technology Hall. Computer science is housed in excellent, recently remodeled space, but doesn't have enough space for its laboratories, classrooms and rapidly growing research programs.

The TASB will present enormous advantages for the College of Science. Foremost will be new laboratory space for teaching and research. The new labs will be designed to accommodate modern teaching and research instrumentation.

Another advantage will be the consolidation of science activities in a science "core." For the first time all of the science departments will be in close proximity to one another on the south end of the UAH campus. The sense of community among science faculty, staff and students will be significantly enhanced.

The rest of UAH will benefit as well. Many research units will be housed in the TASB. Engineering will expand into the Technology Hall space evacuated by computer science. Liberal arts, nursing and the business school could gain badly needed space through renovations in Wilson Hall.

The TASB will be a major step forward for UAH and we are grateful for Senator Shelby's support and efforts in our behalf.



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Dr. Debra Moriarity, Publisher
Science Horizons
UAH College of Science
Huntsville, AL, 35899

Ph: (256) 824-6605 Fax: (256) 824-6819
Direct e-mail to: moriard@email.uah.edu
http://www.uah.edu/science/

Phillip Gentry, Editor • gentryp@email.uah.edu

This stuff is hot, hot, hot

For scientists who study solar flares, the hottest spots in the solar system are a lot hotter than they used to be.

Using data from NASA's Reuven Ramaty High Energy Solar Spectroscopic Imager (RHESSI), scientists from UAH, the University of Glasgow and the University of California at Berkeley were able to isolate and measure sources of the most powerful X-rays emitted by a solar flare on July 23, 2002.

They found that the hottest spots in solar flares reach temperatures as much as 20 million degrees Fahrenheit hotter than previously believed, topping out at more than 80 million degrees Fahrenheit. And from about 5 million degrees just before a flare, in less than a minute temperatures in the sun's atmosphere can heat up by more than 75 million degrees.

"Previously the best we could do was look at an average temperature for the entire flare," said Dr. Gordon Emslie, who presented the findings at a meeting of the American Astronomical Society's Solar Physics Division. "With RHESSI we get an incredible amount of data. One of the things we can do with that is look at the hottest point sources within a flare.

"We have been able to take a picture of the hot spot and the data from that 'ups the ante' considerably."

RHESSI images of the flare show a bright "blob" suspended 7,000 miles above the sun. Below it are three hot spots on the solar surface.

"This suspended blob is extremely hot," said Emslie, a physics professor and dean of graduate studies at UAH. "That's where the temperature hit 45 million Kelvin - about 80,000,000° Fahrenheit, give or take a million. We think the other three bright spots are where electrons from that hot blob are being slammed into the surface. And when they hit they release energy in the form of X rays."

These findings will force Emslie and other solar physics theorists to re-examine the theories they have developed to explain the most massive explosions in the solar system.

"Now we have to stop talking about 30 million Kelvin and start thinking about 40 or 45 million Kelvin," he said. "That represents a bigger concentration of energy that has to be explained in our theories and our models."

The power released by a large solar flare - such as the one on June 23, 2002 - would be measured in the billions of trillions of kilowatts.

If certain types of flares erupt on the side of the sun facing Earth, waves of electromagnetic energy can disrupt telecommunications, black out power systems, and play havoc with satellites. Just as electrical power is generated on the sun by the interaction of magnetic fields, electromagnetic fields from the sun induce electrical current in transformers and power lines on Earth. Those extra surges of power can trip circuit breakers and shut down power systems.

"If we're ever going to be able to predict these things, we have to understand them better," said Emslie.

Biology seeking candidates for Dimopoullos fellowship

UAH's Biological Sciences Department is seeking candidates for the Thomas James Dimopoullos Fellowship.

Through graduate research assistantships, the fellowship supports graduate biology students at UAH, with preference given to students whose research focus is the environment. Preference is also given to students of Greek heritage, if any are available in the applicant pool.

The Thomas James Dimopoullos Memorial Endowment was established by Sophie Dimopoullos and her brother, former UAH biology faculty member, the late Dr. George Dimopoullos.

Thomas Dimopoullos became an environmentalist because of his concern for the Earth. A native of New York, he was an engineer, geologist and environmentalist in the United States, Africa, the Middle East and South America during his career. He made a difference in many lives through his environmental and humanitarian efforts.

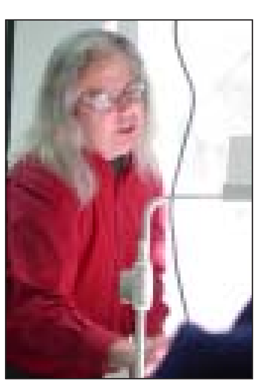
For more information, please contact Dr. Gopi Podila at (256) 824-6263 or by e-mail at podilag@uah.edu

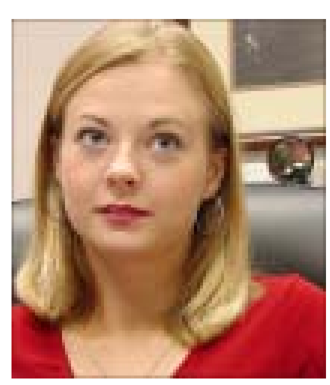
Science Ambassadors

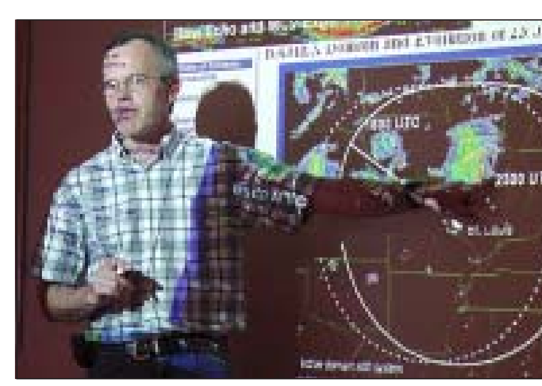
The Science Ambassadors are the official hosts and hostesses of UAH's College of Science. They lend a hand with a variety of college events during the academic year, ranging from recruiting visits to high school visit day to the college's annual picnic. This year's UAH Science Ambassadors are, left, front row from left, Chris Widner, Joshua Stepp, Lisa Monticciolo and Brooke Belyea; top row, Andrew Hodges, Adam Newman and Derek Claxton; right, front row from left, Amanda Black, Angela Rea and Keela Jackson; second row, Adrienne Taylor, Lauren Eiter and Rex Brooks; top row, Aaron Tauchen, Julie Crowder and Sean Anderson. Not pictured: Rebecca Bifulco, Jason Brazelton, Tiffany Freeman, Woody Hunt, Stephanie Michael, Sarah Ridout and Melanie Wilcutt. (UAH photos)

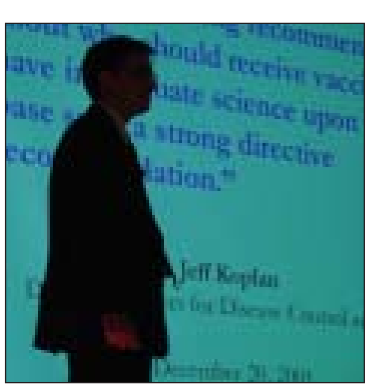
Science @ UAH

Science @ UAH is UAH's new monthly electronic newsletter, highlighting the people, activities and news in UAH's College of Science. If you haven't been getting this FREE newsletter, here are some of the things you've missed:









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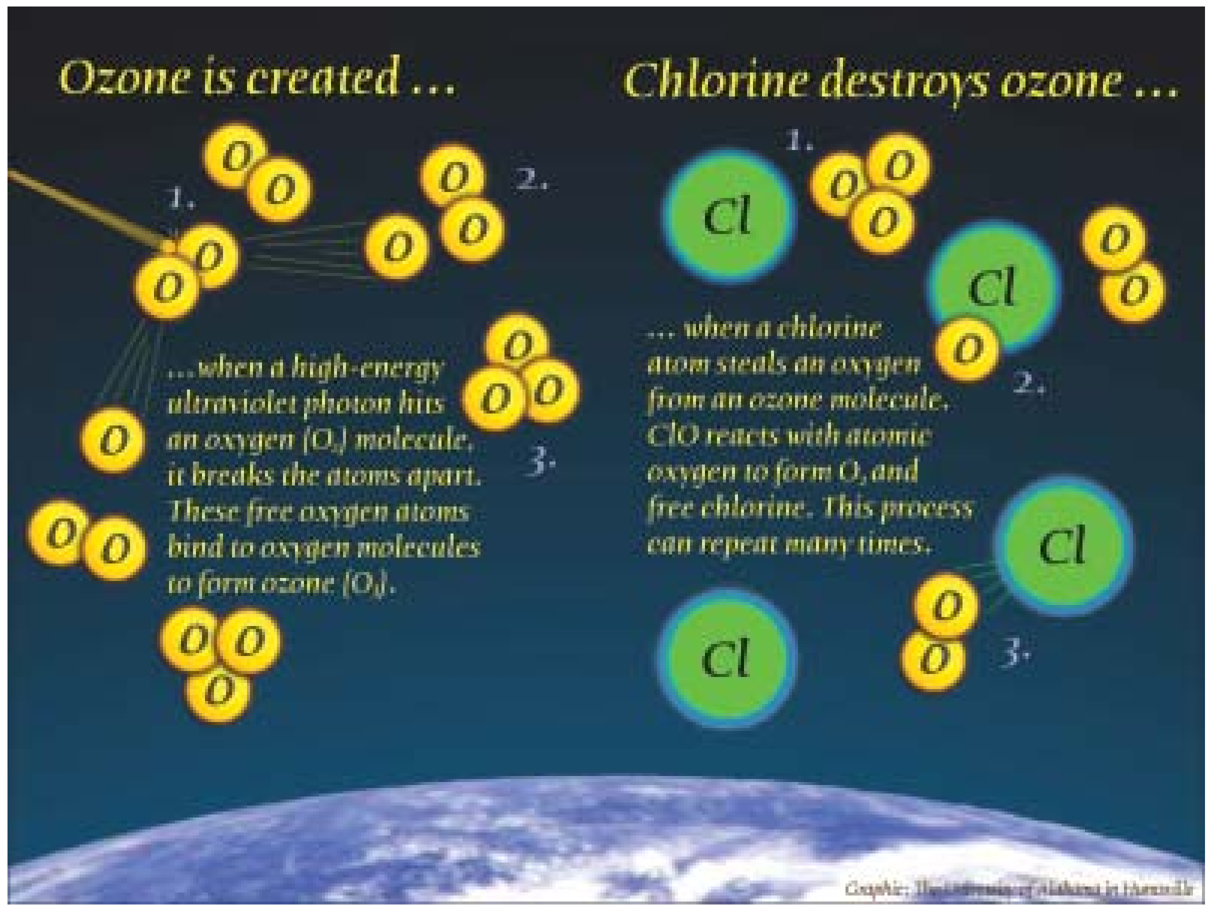
'Now we can say that what we're doing is working and we should continue the ban.'

— Mike Newchurch



Continued from page 1

there's not much ozone up there and it has a small effect on the total ozone column. We don't see compelling evidence that the destruction of ozone is slowing in the lower stratosphere, where 80 percent of the protective ozone layer exists."

Many factors, including chlorine levels, influence ozone depletion in the lower stratosphere — the layer of atmosphere between about 20 and 35 kilometers up.

"Fixing the chlorine problem is never, by itself, going to solve the lower stratosphere problem," Newchurch said. "There are many things that push ozone depletion in the lower stratosphere."

One of those things is the concentration of greenhouse gases, such as carbon dioxide and methane. While these gases warm the lower atmosphere, they cool the stratosphere by radiating heat out to space.

Cooling the stratosphere has both good and bad effects on ozone destruction, Newchurch said. Cooling the air in the upper stratosphere slows the rate of chemically-destructive reactions, thereby increasing ozone amounts. In the lower stratosphere, cooling also changes wind and air mixing patterns in a way that can increase ozone depletion, especially in high latitudes.

Supported by NASA grants and contracts, Newchurch and his co-investigators, including former graduate student Dr. Eun-Su Yang, who is now at Georgia Tech, Professor D.M. Cunnold at Georgia Tech, Professor Gregory Reinsel at the University of Wisconsin, Dr. J. M. Zawodny at NASA's Langley Research Center, and Professor James Russell III in the Center for Atmospheric Science at Hampton University, analyzed satellite measurements of ozone, hydrogen chloride and greenhouse gases along with ground-based measurements of ozone and solar activity.

"As the satellites orbit Earth, they see a sunset and a sunrise once every 90-minuite orbit," said Newchurch. "The instruments look at the sun as it sets or rises, as sunlight is filtered through the atmosphere. Because ozone and other constituents absorb light at known wavelengths, we can measure how much light at those wavelengths comes through the atmosphere and calculate from that the amount of ozone and other gases."

The team used data from instruments aboard three NASA Earth-observing satellites: the Stratospheric Aerosol and Gas Experiment I (SAGE I) instrument aboard the Applications Explorer Mission-B satellite, which operated from 1979 through 1981; SAGE II, which went into orbit in October 1994 aboard the Earth Radiation Budget Satellite and continues to this day; and the HALOE instrument aboard NASA's UARS satellite, launched in 1991 and still returning data.

"The SAGE and HALOE instruments both look at the atmosphere, but they use different techniques and are on different satellites," said Newchurch. "The fact that they both see the same trend in the ozone, which matches the trend seen by the ground-based instruments, is compelling evidence that they are both correct.

"We are extremely pleased to have the highly calibrated, long-term satellite and ground-based data records necessary to observe these small but important changes in the ozone layer," said Newchurch. "It is a tremendous accomplishment that these NASA satellites have measured such minute ozone quantities so accurately for so many years."

Released into the atmosphere, CFC molecules will take several years to "percolate" upward into the stratosphere. As they rise, ultraviolet light breaks up the CFC molecules, releasing chlorine. This free chlorine reacts with ozone, converting two ozone molecules (O_3) into three oxygen molecules (O_2). Eventually most of the chlorine bonds with hydrogen atoms to form nearly inert hydrogen chloride (HCl), which over a period of years drifts into the lower atmosphere. There it dissolves into water vapor and is rained out of the atmosphere. The entire process takes decades.

— Phillip Gentry

News from atmospheric science

By Ron Welch, chair

Dr. John Mecikalski will join the Atmospheric Science Department beginning spring semester.

John earned his Ph.D. in atmospheric science from the University of Wisconsin-Madison in 1999. While working on his Ph.D. and since graduating, John has been a researcher with the Cooperative Institute for Meteorological Satellite Studies at UW-Madison. He also spent a year working with the National Weather Service in Green Bay, WI.

John brings with him an impressive publication and research vita. He is principal investigator or co-investigator on more than ten research grants and awards, several of which will move with him to UAH.

His major areas of interest include dynamics of scale interactions, boundary layer processes, assessing the atmospheric boundary layer and convection using remote sensing, numerical modeling and tropical meteorology.

Welch

His research experience and interests will add to the department's teaching and research foundation.

During the spring, John will teach a graduate course in synoptic meteorology.

Controversy concerning global climate change continues. In response to an article published in "Science" magazine on Aug. 22, Dr. John Christy was interviewed on National Public Radio on Sept. 11. Recently he also testified in Congress before the House Resources Committee concerning the Kyoto Protocol.

In August, Dr. Qingyuan Han paid a visit to the China Meteorological Administration (CMS) to discuss possible collaboration of ground radar observations of precipitation. Such collaboration would strengthen our ability to validate the future Global Precipitation Mission.

A CMS official said Chinese meteorology observation sites are newly equipped with WD-88 radar, the same instrument used in the U.S. The CMS Department of Observations and Telecommunications is trying to collect observation data from all sites.

Dr. Lin Zhou, head of CMS' telecommunications division, showed interest in providing these data as part of the collaboration. Zhou also suggested a visit to the Center of Satellite Remote Sensing, a unit under his leadership, for future collaboration in cloud and aerosol research.

Dr. Kevin Knupp and nine UAH research staff and graduate students participated in the NSF-funded "Bow Echo and Mesoscale Convective Vortex Experiment" in the midwest from May 20 through July 6. Participants included six universities, NOAA's National Severe Storms Laboratory, the National Center for Atmospheric Research, and numerous National Weather Service forecast offices.

The program's goals included getting measurements of bow echoes and elevated mesoscale vortices within large thunderstorm clusters, to better understand how damaging surface winds and thunderstorm regeneration behave in these large thunderstorm systems.

The UAH group assumed a lead role in ground-based measurements, using UAH's Mobile Integrating Profiling System.

During the seven-week project, the MIPS teams logged 16,000 miles through 12 states.

UAH

Teledyne Brown donates $221,000 in teaching, research equipment

UAH has received optics and chemistry equipment worth more than $221,000 as a gift from Teledyne Brown Engineering.

The hardware will support both research and teaching at the university, making it possible for students to gain real-world experiences and conduct research that otherwise would not have been possible.

"We are pleased to have an opportunity to give students at UAH opportunities to have these hands-on learning experiences," said Jim Link, president of Teledyne Brown Engineering, Inc. "Providing this needed equipment to the university is another way that Teledyne Brown is able to enhance the learning process within this outstanding institution.

"UAH is training many of our future engineering and management workforce, and we are delighted to play a role in their education."

UAH students in organic and advanced chemistry classes will put to good use one piece of the equipment, a gas chromatograph that is used to determine the molecular makeup of materials.

"There is no way we could afford something like this for teaching purposes," said Dr. James Baird, chairman of UAH's Chemistry Department. "This will have a heck of an impact on our students."

The chromatograph will be used in at least two chemistry classes, said Baird. "In our sophomore organic chemistry lab, it is essential to know if a student has performed an experiment correctly and prepared the compound called for in the procedure. You can't really give grades in organic chemistry labs unless you can check the success of the experiment.

"We also have a course at the senior level that deals with instruments used for chemical analysis, so we will be training students on how to use that instrument."

In addition to supporting chemistry teaching labs, some of the donated equipment will be used for research in UAH's Center for Applied Optics. That hardware includes a powerful pulsed laser system.

The donated hardware includes chromatography, spectrophotometry, MTF measurement, laser and aqueous particle counter equipment.

Computer science receives $10,000 gift

UAH's Computer Science Department received a $10,000 gift in honor of Dr. Carl Davis, professor emeritus who chaired the department for 15 years.

The gift was made through a grant from the 2003 TRW Education Support Fund of The Cleveland Foundation.

"The university is grateful for the generous support for our Computer Science Department in honor of Dr. Davis," said UAH President Frank Franz.

The funds will be used for lab improvements to support teaching and research in modeling and simulation.

More than $30,000 has been received by the university to endow a fund honoring Davis. The endowment supports student and faculty development and the purchase of equipment that will help keep the department abreast of new technologies.

News from chemistry and materials science

By James K. Baird, chair

In May the Chemistry Department was host to a biomolecular nuclear magnetic resonance workshop organized by Professor John Shriver, Associate Research Professor Steve Edmonson, Assistant Research Professor Enrico DiGiammarino, and Assistant Professor Bernhard Vogler.

This colloquium drew more than one hundred outside participants, with speakers from Duke University, the University of Alberta, Rutgers University, the University of Georgia, Vanderbilt University, and the Varian Corporation, in addition to our local UAH NMR experts.

Associate Research Professor Bill Kaukler has been serving on a NASA committee investigating the failure of the space shuttle external tank foam thermal insulation, which was blamed for the Columbia re-entry disaster on Feb. 1.

The surface of the external tank is covered with more than one-third acre of spray-on foam insulation, most of which is only 1-to-2 inches thick. The foam suppresses boiling of the liquids in the tanks and prevents dangerous ice from forming on the outside.

Bill has been looking into possible mechanisms whereby a piece of this foam might become de-

Baird

tached and strick the leading edge of a wing.

He uses X-ray scattering to examine the microstructure of the foam. To get a strong enough X-ray signal he diffuses iodine into foam samples and exploits the large X-ray scattering power of this element in contrast to the weakly scattering carbon, hydrogen and oxygen elements which make up the bulk of the foam. While his X-ray images have revealed knit lines where foam segments joined, he will need more study before he can put his finger of the specific failure mechanism.

The agreement of reciprocal exchange and cooperation in academic research activities signed by UAH and the Martin Luther University in Halle-Wittenberg, Germany, in 2001 is providing opportunities for German students to study at UAH and UAH students to study in Germany.

Our department has hosted two graduate students from Germany, while Martin Luther University has hosted UAH graduate student Kerry Townsend. She spent the summer in Halle analyzing polymers using surface tension measurements combined with wide and small angle X-ray scattering.

Her UAH advisor is Assistant Professor Carmen Scholz, who provided the impetus for getting this exchange program started. We hope many UAH students will take the opportunity to travel to the German "chemistry triangle" of Martin Luther University campuses in Halle, Wittenberg and Merseburg.

Teledyne Brown Engineering, whose offices are just across Sparkman Drive from UAH, has donated equipment to the Chemistry Department worth more than $100,000. This donation includes a Perkin Elmer gas chromatograph and a Dionex ion chromatograph with UV detector. Assistant Professor Bernhard Vogler is busy refurbishing these instruments and putting them in running order.

Assistant Professor Andreas Gebauer and his wife have immigrated to California, where she was admitted to medical school. Gebauer, who came to UAH in 2000, has joined the chemistry faculty at California State University in Bakersfield. We wish them both success in their new location.

Please keep in touch and let us know where you are and what you've been doing. Send email to chemch@uah.edu.

News from mathematical sciences

By Kyle Siegrist, chair

We are happy to welcome Dr. Leigh Lunsford as a visiting assistant professor for the 2003/2004 academic year.

She is one of our own graduates, having received her PhD degree under the direction of Dr. Claudio Morales in 1995. Since graduation she has worked at Colsa Corporation, at Alabama A&M University and at Athens State University.

While at UAH, Lunsford will be working on a project funded by the National Science Foundation: "Collaborative Research: Adaptation and Implementation of Activity and Web-Based Materials into Post-Calculus Introductory Probability and Statistics Courses."

Thanks to Leigh's grant the department will soon have its first SmartBoard-equiped classroom.

During the summer, Dr. Ravi Ravindran participated in NASA's Summer Faculty Fellowship Program at Marshall Space Flight Center, working on the development of a rocket engine combustion chamber cooling module for the rocket modeling system.

Siegrist

Ravi also organized a mini-syposium, "Control of Fluid Dynamical Systems: Theory and Numerics," at the annual summer meeting of the Society for Industrial and Applied Mathematics in Montreal.

In May, Dr. Peter Slater visited the University of Seville in Spain at the invitation of Prof. Justo Puerto. While there he gave a lecture (in Spanish, no less) entitled, "Procedi-mientos de eleccion social basados sobre distancias en grafos."

Slater, who has also given lectures in French, is one of our most linguistically versatile faculty.

The department hosted a five-day workshop in May on web-based course materials in probability and statistics. I organized the workshop as part of my National Science Foundation project, "The Probability Statistics Object Library." The workshop had 18 participants from eleven states. A second workshop was held at Middle Tennessee State University in June.

Eleven UAH students participated in the spring 2003 William Lowell Putnam Mathematics Competition. Eight of them made at least two points. (The Putnam competition is so difficult that about a half of the participants score zero!)

UAH's math team placed 127th from 376 institutions. Our highest score was 32, which ranked 314th out of 3,349 total participants in the nation. This student was the only student from an Alabama university listed in the Putnam booklet of rankings between 222.5 and 500.

We also had three freshmen participate and score points. Thanks to the inspirational leadership of Dr. Claudio Morales, this was one of the best UAH performances in the last 10 years.

This year we have introduced a new curriculum for students who wish to double major in mathematics and another area of science or who wish to earn a dual degree in mathematics and an area of engineering or administrative science.

This curriculum offers more flexibility in the choice of certain mathematics courses.

UAH

News from physics and optics

By Lloyd W. Hillman, chair

The department welcomes Dr. Richard S. Miller as its newest assistant professor of physics. He comes here from the University of New Hampshire, where he earned his doctorate and spent several years as research faculty.

He also completed a postdoc at the Los Alamos National Laboratories. Miller arrived at UAH in mid-July but has already succeeded in winning his first UAH proposal, "Space-Based Weak Interaction Astrophysics."

Other changes in the faculty include the addition of Dr. John Dimmock, who recently stepped down as director of the Center for Applied Optics and is now teaching full time for the Physics Department.

It's a pleasure to welcome the department's new alumni. Receiving B.S. degrees in physics at the Spring 2003 commencement where Daniel E. Britton, Christopher L Brown, William E. Cuffle, Amanda L. Gates, Dale T. Jobes, Jennifer M. Konecny and Nathan A. Lewis.

Special recognition goes to Amanda Gates for being chosen as the top student in the College of Science and to Nathan Lewis for top physics student.

Earning M.S. degrees in physics were Magnus


Hillman

Akerstrom, Robert Connatser, Wendy Patterson and Dragana Tankosic. Donald Gregeory Chavier, Surasak Phengehamnan and Toshiyuki Shiina received their Ph.D.'s.

Congratulations to all!

Physics is experiencing another growth in undergraduate students this fall with 22 new freshman physics majors!

In addition, our motivational course, "Frontiers in Science" (PH 110), has a record enrollment of 35 students. Dr. Carol Strong has done a marvelous job of inviting outstanding outside speakers for this course. PH 110 is now listed under UAH's Honors Program.

So where do graduates from UAH go? This is my story:

On September 11 I gave the weekly colloquium talk at the Optical Science Center at the University of Arizona, where I earned my B.S. in engineering physics.

While visiting friends and labs I stopped by the office of Dr. Janet Bingham, the university's vice president for university advancement and an old San Manuel High School classmate. She invited me to attend the Arizona vs. Oregon football game in the president's skybox. How could I refuse?

During the first quarter, Janet introduced me to the dean of UA's College of Agriculture and Life Sciences, Dr. Eugene Sanders.

Since I grew up on a cattle ranch north of Tucson, this gave me an opportunity to catch up on the Arizona cattle business. He introduced me to his wife, **Louise Canfield Sanders**.

To my surprise I learned that she is a UAH College of Science alumna! She earned her M.S. in chemistry here in 1972.

After comparing UAH notes with Louise, I found Janet talking with several people and informed her of my UAH alumni discovery.

Hearing UAH, the two people talking with Janet proclaimed, "We're UAH graduates, too!"

They were **Richard T. Myers, '78 BSE, mechanical engineering**, and **Judy B. Myer, '79 B.S., mathematics**.

So of the approximately 30 guests in the University of Arizona president's skybox, about ten percent were UAH graduates. It is a small world.

We don't want to lose track of our physics alumni, so drop us a line and let us know about the exciting things in your lives.

The e-mail address is: hillmanl@uah.edu

News from computer science

By Heggere Ranganath, chair

Another productive and exciting academic year has begun.

Graduate enrollment is on the rise. This year 24 new international students joined our graduate program.

Two outstanding new faculty members, Dr. Ramazan Aygun and Tony Orme, have joined the department.

An assistant professor, Aygun received his B.S. degree in computer engineering and information science from Bilkent University, and his M.S. in computer engineering from Middle East Technical University. Both universities are in Ankara, Turkey. He earned his Ph.D. in computer engineering from the State University of New York at Buffalo in May. His areas of research include multi-media systems, database and data mining.

Orme is pursuing his Ph.D. in computer science at UAH. He is interested in software engineering and distributed systems.

We are happy that they chose our department. I


Ranganath

welcome them and the new students to UAH.

The computer science and ECE departments have joined to bring the 42nd annual ACM Southeast Conference to Huntsville next April 2-3, 2004. Dr. Letha Etzkorn from our department and Dr. Sam Yoo of the ECE department have taken the lead and are working hard to make the ACM conference a success.

Etzkorn is the conference program chair, while Yoo is the general chair.This confer ence is the oldest continuously-running annual conference of the ACM. Papers are invited in all areas of computer science and engineering as well as for two special tracks, mobile computing and software systems.

As usual the CS department is taking the lead in providing advanced education responsive to the evolving needs of the community and nation. We are in the process of obtaining approval to offer two graduate certificate programs, one in information assurance and the other in modeling and simulation.

To support these programs, the department is offering two new graduate courses in modeling and simulation, and one new course in computer system security.

Please join me in congratulating our ACM programming team and Chunguang Cao for their accomplishments. Our programming team did very well in the programming contest at Orlando. The team placed in the top 20 percent, ahead of most universities in the region.

Cao, one of our graduate students, participated in a student project contest sponsored by the IEEE Computer Science Technical Committee on Computational Medicine. He was the runner-up in this national contest.

As always, please keep in touch and let us know where you are and what you are doing. You can e-mail me at: ranganat@cs.uah.edu.

UAH

News from biological sciences

By Gopi Podila, chair

Podila

Dr. Amy Bishop, a neurobiologist from Harvard University, has joined our faculty as an assistant professor.

Her research deals with various aspects of neuron responses to stress and neural development. She adds a new dimension to our department's research and teaching potential.

Dr. Khursheed Anwer, vice presi-dent for research at Expression Genetics Inc. and Dr. Russula DeBreuil, head of research and development at Open Biosystems, joined our department as adjunct faculty.

The department is moving forward with these changes and we hope to make the department stronger both in teaching and research, and increase its visibility.

Our efforts to provide a quality undergraduate education seem to be working. This fall our freshman enrollment is up more than 20 percent.

While we are happy with this, it also means we need to find resources to teach additional classes and teaching labs. We are seeking support from various local corporations to equip the teaching labs. We would like to hear from you if you have any suggestions or are willing to help improve our teaching lab facilities.

We made more improvements to the biology reading center in Wilson Hall room 107 by adding a couple of computers for students to use and by increasing the number of books in the reading center library.

Dr. Bill Garstka spent the summer back in North Dakota finding more clues on triceratops bones.

Dr. Joe Ng and Dr. Owen Garriott organized a trip to the bottom of the Pacific Ocean in September in submersibles carried aboard the Russian research vessel *Keldysh*. From samples collected near hydrothermal vents they have isolated several thermophile bacteria that can grow at 120 degrees Celsius.

Dr. Bob Lawton spent his summer in Costa Rica working on NASA and NSF-funded research on cloud formation and forest dynamics. He worked with the National Center for Atmospheric Research to launch several balloons carrying instruments to collect data.

In her capacity as associate dean of science, Dr. Debra Moriarity spent two weeks in June at Harvard University, where she participated in the Management Development Program of the Harvard Institutes for Higher Education. She enjoyed the chance to be a student again, and learned a great deal about administration and management in higher education. She also got to see the Red Sox at Fenway Park.

Moriarity is also the principal investigator on an NIH grant that will fund research by UAH's Natural Products Group in its search for potential new breast cancer drugs from tropical plants.

Dr. Bruce Stallsmith was selected last spring for a UAH Foundation Distinguished Teaching Award. He has given new life to the introductory biology courses and his style of teaching has won accolades from students. So many students wrote letters nominating him for the teaching award that his selection was a natural.

Stallsmith hosted the annual meeting of the North American Native Fishes Association at UAH in June. About 80 people came to the meeting, which included a full day of presentations on native aquatic fauna, and two days of field trips to local rivers and creeks.

He has also been chief biologist in two freshwater mussel surveys locally. One was at Lindsey Creek off of Lake Guntersville in July. One is an ongoing project, working with a team of divers to remove, identify and relocate mussels near the Whitesburg Bridge over the Tenessee River, so they aren't harmed by bridge construction activities. They have found two species of endangered mussels among the 16 species collected so far.

Patricia Batchelor, a graduate biology student, won the outstanding graduate teaching assistant award from the College of Science. Several biology undergraduate students were recognized for their excellence in studies and also service as Science Ambassadors during the College of Science honors convocation.

Dr. Maria Davis won an educational "mini-grant" from UAH to develop a web-based review course for cell and developmental biology. Over the summer, Davis and her students developed the BYS 340 website, which they launched in September. It serves as a great resource for students who want to study and prepare for BYS 340, as well as other cell biology-related courses.

Dr. John Shriver organized the first Biomolecular NMR workshop at UAH in May. There were about 100 participants.

I organized an NSF-funded Indo-U.S. workshop on the biotechnological applications of mycorrhizal fungi in New Delhi, India, in March. I organized a delegation of six professors from various U.S. universities to present talks at the workshop, which was attended by more than 150 delegates from Southeast Asia.

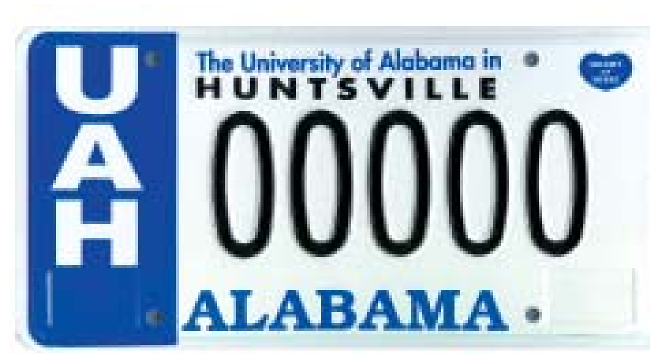
And I was invited to deliver symposium talks on genomics and proteomics of mycorrhizal symbiosis at the 4th International Mycorrhiza Conference in Montreal, and also at the 4th International Symbiosis Society meeting in Halifax in August.

Please visit our new (and improved) website at: www.uah.edu / biology

As always, we like to hear from you, and we welcome your comments, ideas and suggestions. You can e-mail us at podilag@uah.edu

UAH

Home Plate



You support budding scientists and more when you buy a new and improved UAH automobile license tag, which is on sale at courthouses throughout Alabama! In addition to announcing your pride in UAH, your tax-deductible $50 fee for one of these distinctive limited-edition designer plates supports student scholarships for deserving young people attending UAH. And it's so easy to get! "Trade up" on your annual renewal date by writing "UAH Collegiate Tag" on your renewal notice and adding $50 to the amount listed. But why wait? You can trade in your old tag for a UAH tag at any time, and you won't lose any credit for taxes already paid. Support UAH's "Roads Scholars" today!

UAH wins $1.9 million NSF grant to develop weather analysis tools

NOAA file photo

Virtual tools; Real storms

A $1.9 million grant from the National Science Foundation will help computer scientists at UAH develop tools that might lead to faster and more accurate forecasts of dangerous weather events.

The five-year grant to UAH's Information Technology and Systems Center (ITSC) will fund development of tools and technology linking forecasters and researchers to both real-time weather data from all parts of the globe and cutting-edge data analysis tools.

The UAH group is charged with developing "data mining" tools and an international vocabulary that will help scientists tap into weather data gathered and stored by organizations around the world.

"There is a flood of weather data being collected today," said Dr. Sara Graves, the ITSC director. "But a lot of that data is in depositories in many countries and is stored in many different data formats. So even with the increased volume of data, it doesn't mean the data is useful."

One of the UAH team's chores during the next five years will be to study the semantics used in different systems, then to develop a standard terminology.

"We have to be sure everyone understands what the data means before it can be used easily and correctly," said Graves.

The UAH group will also refine software developed at UAH to help scientists dig the data they need out from among billions of bits of weather information collected every day.

"You have to deal with the shear magnitude of the data that is available," said Graves. "That's where data mining comes in. The data isn't useable or valuable if a scientist or forecaster can't find the information that they need in a timely manner."

These systems are essential elements of an advanced, international computer grid.

"What the grid is all about is an environment in which people can find computational resources, data and tools for retrieving and analyzing that data," said Graves. "Let's say someone wanted NEXRAD data. On the grid they would be able to find that data at one place, find a tool, such as UAH's data mining, at another site, then use computer resources at a third location to use that tool to find, retrieve and analyze the data.

"UAH is coming up with tools and services that anyone in the atmospheric science community can use to find the information that they need."

This flow of real-time weather data will also allow scientists to develop on-demand hazardous weather detection systems that can recognize and react to changing weather conditions, even directing Doppler radars to collect specific data needed to track weather systems and to make severe weather forecasts.

In addition to UAH, other participants in the NSF's Linked Environments for Atmospheric Discovery (LEAD) program include the University of Oklahoma, the University of Illinois Urbana-Champaign, Colorado State University, Indiana University, the Universities Center for Atmospheric Research, Howard University and Millersville University.

These institutions will develop computing tools for on-demand detection, simulation and prediction of weather events, such as severe thunderstorms and tornadoes. These tools will be integrated into four testbeds, including one hosted by UAH, which will be introduced in three phases over the next five years.

Contact

Film inspires Ridout to Space Academy and UAH

UAH sophomore (and Space Academy alumna) Sarah Ridout

Sarah Ridout took a simulated trip into space three years ago. So did the polyester-producing bacteria she studied last summer.

The bacteria experienced a kind of simulated "weightlessness."

Sarah wants to experience the real thing.

For the UAH sophomore majoring in astrophysics and chemistry, becoming an astronaut has been a career objective since her freshman year at DAR High School in Grant, Ala., when she saw the Jody Foster movie, "Contact."

"That's when I really decided that I want to travel in space," she said recently. "I did a lot of research on what I ought to major in; science or engineering. So I decided to do what I really like, astrophysics."

A UAH freshman chemistry class with Dr. Carmen Scholz convinced Ridout to double major.

Like thousands of other high school students who share an interest in space travel, Ridout went through the U.S. Space Academy in Huntsville.

"I enjoyed going to the lectures and doing all the training," she said. "And I really enjoyed the six-hour mission. I was a payload specialist, so I got to be the 'doctor.'

"Being 'up there' and having to deal with everything while you're trying to do experiments … It was great."

While the experiments in the Space Academy mission were simulated, the research projects in which Ridout participated last summer were very real.

Through the Research Experiences for Undergraduates program, Ridout studied how an anerobic bacteria, *Rhodosprillum rubrum*, responds to stress — especially simulated microgravity.

In particular, Scholz wanted to know whether growing in microgravity might encourage the bacteria to produce a polyester polymer that it uses to store energy.

Since flying the bacteria into space is both expensive and time consuming, microgravity was simulated using a bioreactor — a slowly rolling drum that keeps the bacteria from finding a proper up and down orientation. Stress was induced in the earthbound bacteria through the use of a "shake flask."

"I would grow it for eight or 12 hours and then, when it stopped, compare the optical density in both containers," Sarah said. "And I found more (bacteria) in the bioreactor."

This supports a theory that these bacteria will grow faster and produce more of the polyester polymer in microgravity than they do on Earth.

"That was a lot of fun, but I had to catch up on a lot of biology," said Sarah.

The research was fun and educational, but Sarah doesn't know whether she will participate next year: She has opportunities for jobs at both Space Academy and Redstone Arsenal.

Cosmic explosion appears in 'orphan' data

Continued from page 1.

(MeV) per photon — "several thousand times higher energy than we're used to seeing." And, while the lower-energy part of the burst spiked and faded as expected, the highest-energy (MeV) component remained steady and bright for more than 200 seconds.

It was a remarkable display of power. None of the prevalent theories used to explain gamma ray bursts could account for that kind of phenomenon.

"This was pretty dramatic," said Dr. Robert Preece, an assistant research professor of physics at UAH and Kaneko's graduate advisor.

It was dramatic enough to make a graduate student cautious.

In fact, this data made two graduate students downright wary. The University of Wisconsin graduate student who found the burst data was so convinced it had to be a machine error that she let it sit for three months before trying to figure out how the data was corrupted.

When she and her faculty advisor couldn't find a good reason why the data shouldn't be real, she turned to Kaneko and Preece, two "orphan data" team members.

"It's a long way from the satellite until we get the data," said Kaneko. "Anything can happen. There are so many things that can go wrong. So we really made sure this is not an artificial artifact, that it's real data. I did every test I could think of for artificial errors."

For almost two months she tested and probed the data. "I was, like, devoted to this, every day," she said.

Finally she and Preece arrived at the same conclusion as the UW pair: "We had to believe that it was real because we couldn't think of anything we did wrong. We just had to be convinced."

Now the analysis of this data will be part of her doctoral dissertation, says Kaneko. An initial report was published August 14 in the scientific journal, Nature.

Kaneko hopes to complete her doctorate by May 2005. She doesn't know where she will go after that, although she came to the U.S. with the goal of working for NASA — perhaps as an astronaut.

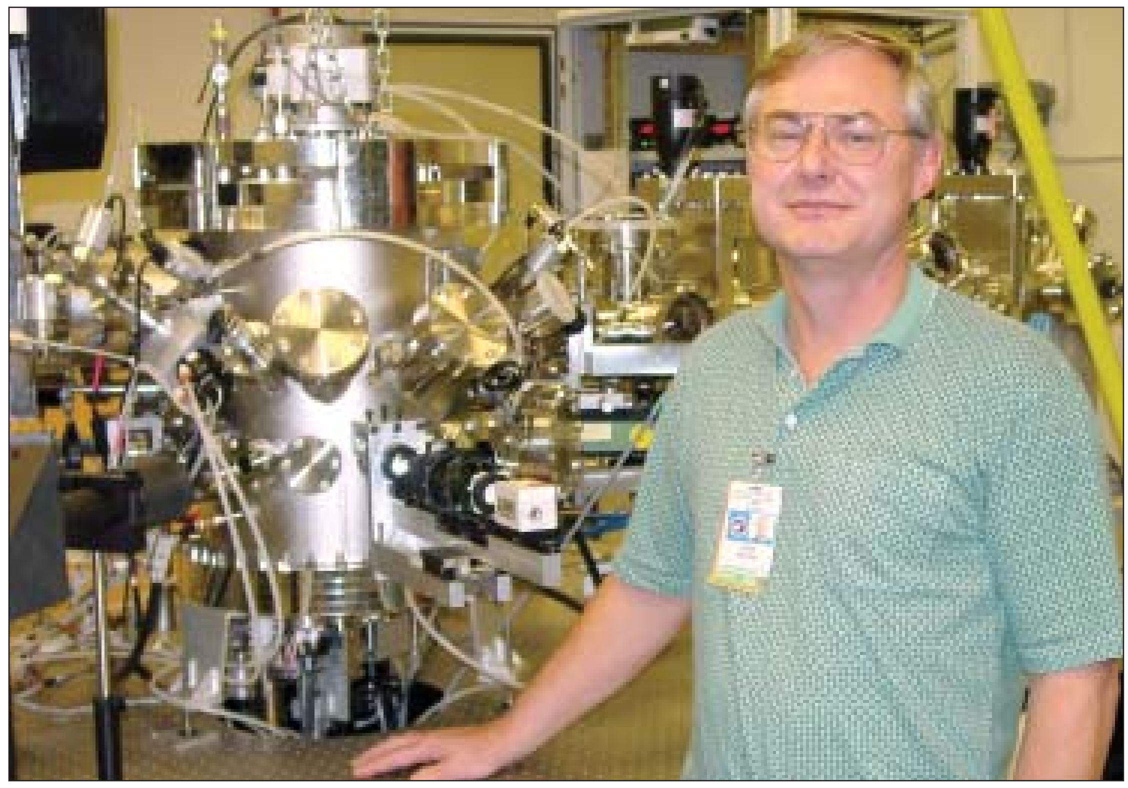
How does evidence of one of the more powerful explosions in cosmic history slip through the cracks for almost a decade?

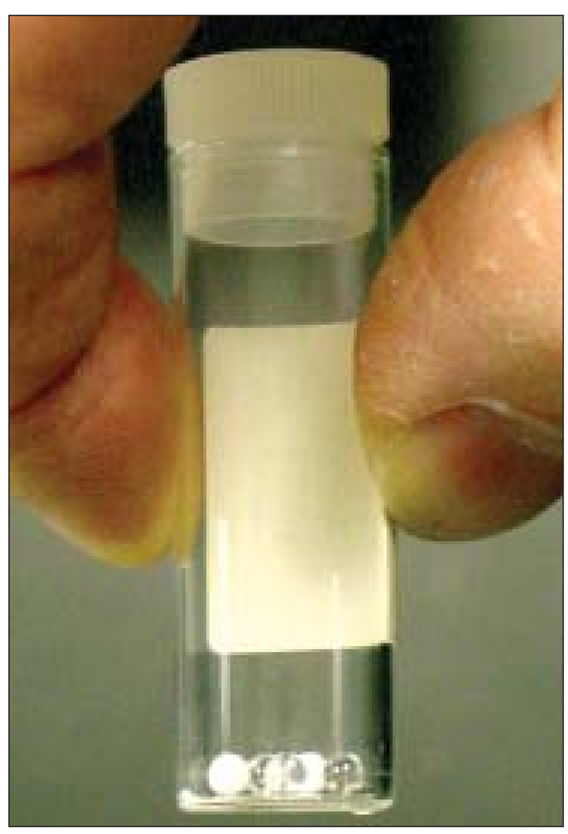
Since the data was collected by an instrument designed to do something else, no one paid attention to the extra data as it came down from space, says Kaneko. Although it gathered readings on more than 40 gamma ray bursts between 1991 and 2000, the TASC instrument aboard NASA's Compton Gamma Ray Observatory was designed primarily to measure the energy of events recorded by another sensor.

After the Compton observatory made a fiery return to Earth in 2000, Preece got NASA support to go through the backlog of data from the satellite's instruments.

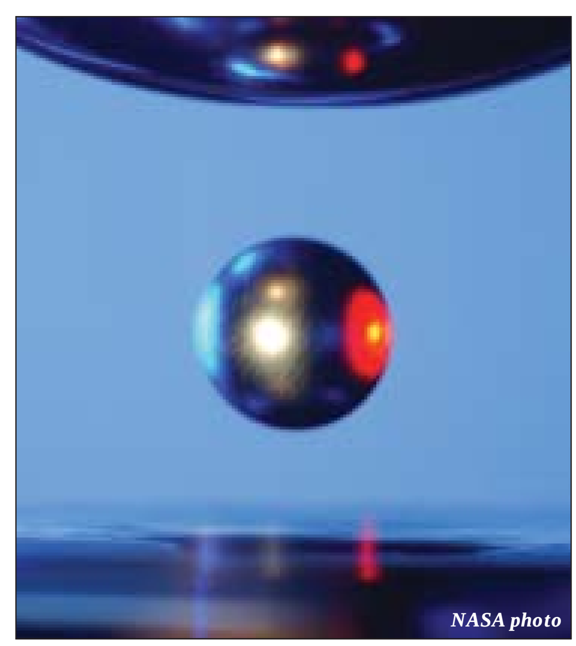
> Yuki Kaneko pretty much missed the thrill of having her first major research publication in *Nature* on Aug. 14. Instead of taking time to enjoy that career milestone she had to focus on another: Passing her doctoral qualifying exams the next day.
>
> "I'm just happy that I'm over it," said Kaneko, now an official UAH doctoral candidate in physics.

Just hangin' with Rathz





Tom Rathz, above, and the new electrostatic levitator at NASA's Marshall Space Flight Center. The tiny samples being levitated — the pellets in the vial, left, are sapphires — are heated by laser until a molten bead is floating in mid-air.



NASA photo

Tiny heated molten beads of metals and glass will do some pretty unexpected things if you make them hang around long enough.

Molten metals might stay liquid at temperatures hundreds of degrees below their normal freezing points.

Or they might solidify into forms unlike anything that has ever been seen.

Or they might even help us better understand the physical processes that happen when a liquid turns into a solid.

Those are some of the projects that **Tom Rathz, '80 M.S. physics, and '98 M.S., materials science**, is working on with scientists from around the country.

Contracted through UAH's Center for Automation and Robotics, Rathz is operations coordinator of the Electrostatic Levitator Laboratory at NASA's Marshall Space Flight Center. The levitator gives researchers a tool for processing test samples suspended in mid-air, without the need for a container.

The slightly larger than BB-sized test pellets are put atop a pedestal and inserted between two copper plates inside a pressure vessel. Under near vacuum conditions, a 20,000-volt negative potential is applied to the top electrode (see picture).

Bombarded by ultraviolet radiation, the pellet loses electrons and gains a slight positive static electric charge. Now it is drawn to the charged plate above. A little fine-tuning, withdraw the pedestal and ... the sample is levitating.

Suspended between the plates, a test sample can be laser heated or cooled at different rates through a wide range of temperatures. High-speed cameras and other sensors keep track of what is happening to the sample, such as its viscosity, surface tension, and temperature.

One interesting phenomenon scientists are studying is the formation of different phases in some materials, especially metals. Because the molten bead isn't touching anything, there is nothing to bring order out of the chaotic atoms floating in the liquid. With nothing to trigger the crystal-forming process some beads stay liquid more than 200 degrees below the temperature at which the metal would normally have solidified.

Other metals 'solidify' like glass, becoming a "super cooled liquid" without crystals or other structures that might reduce the hardness or other properties. (An example of a supercooled liquid is freezing rain, "where you don't get the crystals until impact with the ground," said Rathz.) One supercooled metal material is being used commercially on the faces of golf clubs.

"Depending on the amount of supercooling in these liquids, you can obtain various solid phases," said Rathz. "Some of these phases grow like snowflakes, where you have liquid in the spaces between the dendrites.

"If you could splat your sample onto a chilled plate (*A process called "splat quenching." No kidding.*) ... you might be able to freeze the liquid fast enough, locking in the metastable phases - phases you wouldn't get in day-to-day processing. One way to get these phases is to be in an undercooled state."

Rathz' levitation work continues containerless research that started just after he arrived in Huntsville in 1975.

Rathz became part of a NASA group developing a 30-meter drop tube, a long vacuum tube that lets scientists see how molten materials solidify while falling containerlessly and in "microgravity." This was work done in advance of materials processing experiments done in space by several organizations, including UAH.

He was hired by UAH 16 years ago to work on a new 100-meter drop tube in MSFC's Dynamic Test Stand.

While the NASA / contractor team with whom Rathz works has developed a new levitator that will let them do experiments at high pressure as well as in vacuum conditions, he hopes the team might one day take its research to the next logical step aboard either a space shuttle or the international space station.

"In space, you would use the apparatus just for positioning the sample, not for levitating," he said. "And we could process much larger samples."

In the meantime, Rathz expects a steady flow of metal and glass beads from the scientists who use the levitator for their research. The ESL team is also looking at how they might use the quiescent environment of the levitator to grow fragile organic crystals for medical, genetic and biotechnical research.