



Leitner Family Observatory and Planetarium

Leitner Family donates funds for a Planetarium at the Observatory

The Leitner Family Observatory and Planetarium (LFOP) is the newest incarnation of the tradition of Yale observatories, begun in 1830 with the Atheneum observatory and continuing through the previous observatory on top of a Yale parking garage. In 2005, thanks to funds donated by Mr. James Leitner ('75 BA) and his wife, Sandra, a former carpentry shop located in the Farnham Memorial Gardens near the corner of Edwards and Prospect Streets in New Haven was turned into an observatory that is now accessible to both students and the public. More recently, the Leitners have donated funds to add a planetarium to the observatory, which is anticipated to be completed by January 2009.

David Thompson is the architect for the project, which began in 2005 with the construction of two

(SEE LFO, p.4)

Big telescopes offered at Yale

Yale reaches agreement with Caltech for access to Keck Telescopes in Hawaii

Yale and Caltech have reached an agreement which will give Yale astronomers access to the telescopes of the Keck Observatory for the next ten years. In exchange for fifteen nights per year on the two Keck telescopes, Yale University will pay \$1.2M per year to Caltech. This is the largest single investment that Yale has ever made for astronomy, and is the latest example of Yale's commitment to the sciences.

The Keck telescopes are the world's largest, and the Keck Observatory is broadly considered (along with the European VLT) the pre-eminent optical observatory in the world.

Keck Observatory is located at the summit of Mauna Kea, on the Big Island of Hawaii. Mauna Kea is generally recognized to be one of the best telescope sites in the world, by virtue of its 14,000-foot altitude and clear, calm, and dry skies. The observatory has twin 10-meter diameter telescopes which are normally operated independently, but can also be used together for interfer-

ometry. Keck I began operating in 1993, and Keck II followed in 1996. Keck is operated jointly by Caltech and the University of California.

Keck Observatory has a full suite of world class instruments, and continues to develop new ones. The DEIMOS optical multi-object spectrograph is perhaps the best such spectrograph in the world, and the MOSFIRE multi-object IR spectrograph now under construction promises to be similarly outstanding. Keck Observatory is a leader in adaptive optics (AO), and produced the world's first AO system on a large telescope. Keck's present AO system has higher resolution and greater sensitivity than the Hubble Space Telescope, and the capabilities of its Next Generation Adaptive Optics System (NGAO) will exceed those of the next generation space telescope (JWST).

The Keck Observatory has dominated ground-based astronomy

(SEE KECK, p.4)

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Greetings from the Chair



There is a lot to talk about since our last newsletter because...well.. this is our first newsletter! Although we've been wanting to do this for a while, we finally have a staff person with the time and skills necessary to make it happen (thanks Victoria!). I'll try to focus on recent news and resist the urge to summarize everything that has happened since 1701. We'll try to do the newsletter on a regular basis, as it is a great way to keep our alumni friends informed.

We are living in an enormously exciting time in astronomy and astrophysics. Over the last decade astronomers have made fundamental discoveries about dark energy, dark matter, gamma ray bursts, the cosmic microwave background radiation, the early universe, galaxy formation and evolution, black holes, and planets beyond our solar system. There are many new telescopes on earth and in space covering most of the electromagnetic spectrum. More facilities are focused on the time domain, and huge amounts of high quality data are available on the internet (thanks Al Gore!). At the same time, Yale is increasing its focus on the sciences and making substantial new investments in scientific research and education. This all makes it a time of great change and opportunity!

In recent years, there has been increased astronomy activity at Yale beyond the Astronomy Department. In 2001 the Physics and Astronomy departments established the Yale Center for Astronomy and Astrophysics (YCAA) to help coordinate astronomy activities and resources. The YCAA is directed by Prof. Meg Urry, who is also currently the chair of the Physics Department. (Please don't tell the physicists that she is really an astronomer!) In the newsletter, we will focus a bit more on things centered in the Astronomy Department, but we will also include reports on astronomy activity in the Physics Department, since in many ways there is no clear boundary and many people have affiliations with both departments.

We are thrilled that Yale has committed \$20M for telescopes over the next 10 years, including access to the Keck 10-meter Telescopes, along with continued participation in the WIYN 3.5-meter and SMARTS 1m-class telescope consortia. Yale has started to improve our access to high performance computing facilities, and we hope to make more progress here over the coming years. We are approaching the 10th anniversary of the Yale-Chile

Joint Program in Research and Education, an international program which provides opportunities for graduate students and faculty from both Yale and Universidad de Chile, as well as Yale undergraduate students. Our new summer astronomy course in Chile for Yale undergraduate non-majors is a big hit (thanks Professor Jose Maza!) which we hope to expand upon.

We are enthusiastically awaiting the completion of the Leitner Family Planetarium, which will soon join the still-pretty-new Leitner Family Observatory on the Yale campus. These educational facilities are far superior than anything we've ever had (thanks Jim and Sandra Leitner!) and offer "hands-on" ("eyes-on"?) astronomy experiences for Yale undergraduates, both majors and non-majors. We are now exploring ways to reach more K-12 public school children and the general public with LFOF.

Classroom teaching is also changing, due to new technology and research into effective teaching techniques. In some of our undergraduate classes, all the students use remote polling devices, which allow them to anonymously answer questions. This makes class more interactive, and allows the instructor to immediately find out what the students are understanding.

One of our courses, "Frontiers and Controversies in Astrophysics", taught by Prof. Charles Bailyn, '81 BS, is available to the entire world via the internet. Recognizing the importance in society of both science and quantitative reasoning (QR) (math and problem solving and quantitative thinking), Yale now requires all undergraduates to take both Science and QR courses. We agree that this is the right thing to do, and have devoted increased attention to teaching QR skills in some of our non-major courses.

The faculty ranks are changing as well. Pierre Demarque, '68 MAH and Bill van Alstena, '75 MAH claim to have retired in 2001 and 2007, respectively, but we haven't yet seen real evidence to support their claims. Sabatino Sofia '63 BS, '65 MS, '66 PhD is planning to retire at the end of this year, and is looking forward to spending quality time with his research program relating solar variability to climate change on earth. New faculty since the start of the new century include Pieter van Dokkum, Marla Geha, Hector Arce and Daisuke Nagai. There's a bit more about each of them in the newsletter.

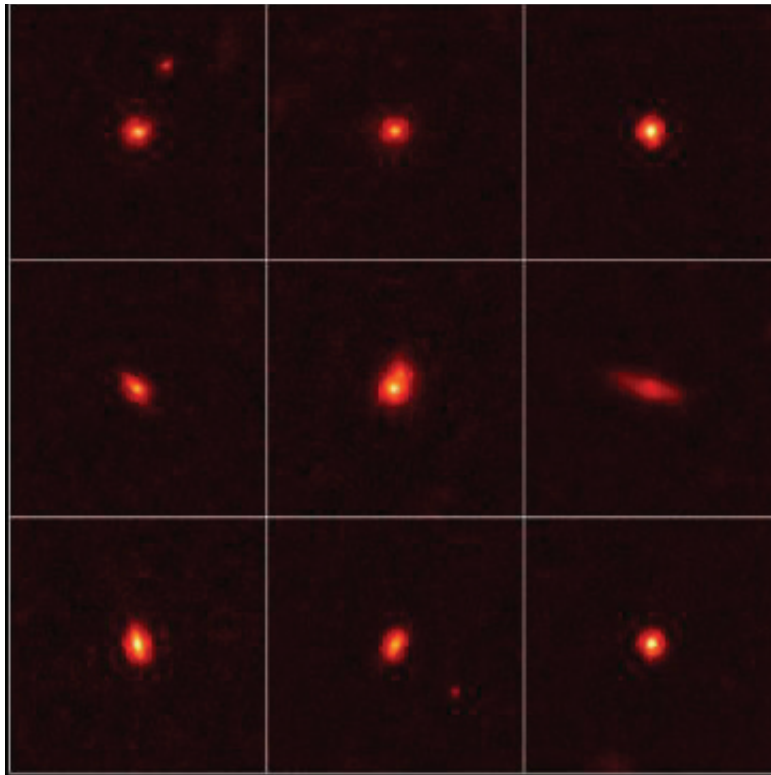
While the rapid changes in the field require that the Astronomy Department change in some ways, there are some things that will not change. One of these is our dedication to our students, and our desire to help them prepare for their career or next stage of life.

We really enjoy hearing from our alumni, and hope that you will let us know how you are doing!

BUT HOW ARE THEY SO SMALL?

Dr. Pieter van Dokkum of the Yale Astronomy Department led a team of astronomers in discovering nine surprisingly compact galaxies in the distant past, using both NASA's Hubble Space Telescope (HST) and the W.M. Keck Observatory (see also article on Yale and Keck, p. 1) on Mauna Kea, Hawaii. The galaxies, whose light has traveled for 11 billion years before reaching Earth, are extremely small yet have a mass that exceeds that of the Milky Way.

Each of these galaxies is only 5,000 light years across, but weigh about 200 billion times the mass of the Sun. The ultracompact galaxies might comprise half of all galaxies of that mass 11 billion years ago, van Dokkum said, forming the building blocks of today's largest galaxies.



The nine ultracompact galaxies.

van Dokkum said, "Seeing the compact sizes of these galaxies is a puzzle. No massive galaxy has ever been observed to be so compact. It is not yet clear how they would build themselves up to become the large galaxies we see today."

How did these small, crowded galaxies form? One way,

suggested van Dokkum, involves the interaction of dark matter and hydrogen gas in the nascent Universe. Dark matter is an invisible form of matter that accounts for most of the Universe's mass. Shortly after the Big Bang, the Universe contained an uneven landscape of dark matter. Hydrogen gas became trapped in pockets of the invisible material and began spinning rapidly in dark matter's gravitational whirlpool, forming stars at a furious rate. Confirmation of these theories might require measuring the velocities of stars in these compact galaxies; a measurement that cannot be done today but will be possible with extremely large telescopes planned for the next decade.

van Dokkum and the other astronomers used the Near Infrared Camera and the Multi-Object Spectrometer on Hubble and they used a laser to correct for image blurring on Keck. Their paper, *Confirmation of the remarkable compactness of massive quiescent galaxies at $z \sim 2.3$: Early-type galaxies did not form in a simple monolithic collapse* was published in the *Astrophysical Journal Letters*.

Above picture credit: NASA, ESA, P. van Dokkum, M. Franx, G. Illingworth



An artist's view looking inside an ultracompact galaxy from a hypothetical planet.



An artist's scale comparison of the size of the Milky Way galaxy to an ultracompact galaxy

Observatory and Planetarium have resources for students, public

LFO

From Page 1

Ash domes that contain a 16" telescope and an 8" refurbished Grubb refractor that was originally purchased by the astronomy department to observe the 1882 transit of Venus. Between the domes there is an observing deck with four permanent piers for five 8" telescopes that can also be used with tripods. A 12" LX200 Meade Schmidt-Cassegrain telescope, formerly housed in one of the domes, is also still available for use.



ROBERT BENSON PHOTOGRAPHY

Outside the Leitner Family Observatory and Planetarium

The 16" telescope can be controlled remotely from a warm room or over the Internet. Yale owns several detectors that can be used with the 16" telescope, including an STL 1001E CCD camera and a DSS-7 spectrograph. The observatory also offers a 10-ft radio telescope, which is used in Astronomy classes and for special projects.

In 2006, the project refurbished the southern interior of the original building to incorporate a lecture hall and a museum dedicated to the history of astronomy, complete with artifacts that have been donated by the Peabody Museum.

Due to another generous donation from the Leitner family, the project is now adding a 30 foot hemispherical domed planetarium theater to the observatory campus. The planetarium's Spitz digital projector will be equipped with a

Starry Night based interface that allows a star field to be projected onto the ceiling. The digital theater setup also allows for a wide range of shows to be presented.

The primary use of the observatory and planetarium is undergraduate research and education. The facilities are used for astronomy classes at Yale College, such as the Introduction to Astronomical Observing and the Introduction to Astrophysical Research Techniques classes, as well as for other introductory and advanced

courses, and students taking these courses can access the building at all hours through keycard swipe access.

The observatory is also used for public outreach events, such as lectures and observing nights, and it is open to the public on the first and third Thursday of the month, weather permitting. The planetarium will be used for classes geared towards both aspiring adult astronomers and public school students once funding is available.

LFOP is also used by STARRY, the Yale undergraduate astronomy club, which meets at the observatory on the 2nd and 4th Thursdays of the month and the New Haven Astronomical Society, which meets on the last Tuesday of every month.

The director of the observatory is Dr. Michael Faison.

Yale invests in astronomy and joins Keck consortium partnership

KECK

From Page 1

for 15 years. It has been extremely productive scientifically, and astronomers using the telescopes have produced high impact results on the accelerating universe, the star-formation history of the universe, the black hole at the center of the Milky Way, and exoplanets.

In addition to the 15 nights per year being purchased, Yale astronomers will have the opportunity to propose for an additional 5 nights per year in collaborative projects with astronomers from Caltech or Swinbourne University, who has also recently agreed to purchase Keck nights.

With access to the world's largest optical telescope, along with continued access to WIYN and SMARTS telescopes, Yale faculty, postdocs, and students are able to use ground-based optical telescopes with a range of apertures for their research.



Keck telescopes.

Sofia studies the effects of solar variability on climate change

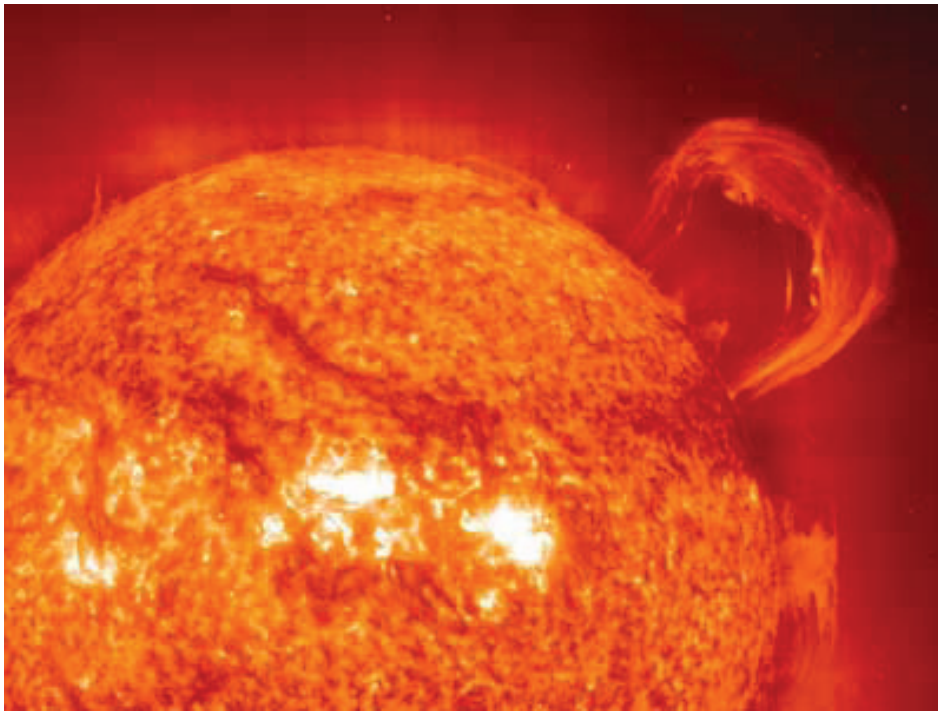
Professor Sabatino Sofia, '63 BS, '65 MS, '66 PhD, of the Yale Astronomy Department has been working on modelling the Sun since the late 1970s, when he still worked at the NASA Goddard Space Flight Center. He has since come to Yale (in 1985) and has worked with many collaborators, but his constant goal has been to come ever closer to an accurate model of the Sun.

Having an accurate model of the Sun can allow astronomers to determine if the Sun has any effect on Earth's climate change, and, if so, how and how much. The question of whether the sun effects the climate change on Earth has been a subject of controversy for many years, and Sofia and his collaborators hope to be able to resolve this debate with the help of their solar models,

developed throughout the years, together with the data that they hope to obtain from two new telescopes, one being launched by the French (PICARD) and the other by the United States (the Solar Dynamic Observer (SDO)).

Sofia and his collaborators determined several important results from their theoretical model of the Sun. First of all, they determined that the external variations of the Sun's energy output (i.e., sunspots, faculae, and the magnetic network) are not large enough to cause large amounts of climate change on Earth, which led them to try to determine the energy output variation caused by changes of the interior structure of the Sun. Secondly, they realized that they would not be able to determine the variation of the interior structure without being able to make precise, simultaneous measurements of certain properties of the Sun, including: the total average radiation flux of the Sun

to the Earth, the diameter of the Sun, the photospheric temperature of the Sun, and the amplitude of solar oscillations. The team also required data from a variety of solar images through various filters (some which enhance and others which minimize the effect of activity).



Once the need for simultaneous observations was realized, Sofia and his collaborators began working with the Centre National d'Études Spatiales (CNES) to develop PICARD, the instrument that would be able to collect the data needed to create a more sophisticated model of the Sun. By happy coincidence, United States astronomers were already working on the Solar Dynamics Observatory (SDO) to measure solar properties,

so the data gained from SDO can be added to the data obtained from PICARD.

Proper interpretation of the new data requires more sophisticated solar models than have been in existence until recently. The new models need to be at least two-dimensional and include effects of both magnetic fields and turbulence. Developing software to create such models has been done by Sofia's group at Yale and they are currently working on refining the models.

Scientists have observed that both natural and human factors play a role in climate change on Earth, but are not certain about their relative proportion. Understanding the role of a natural factor, the Sun, will enable us to begin to understand what the causes of climate change are and how much humans may need to adapt their lifestyles.

Spectacular image shows evidence for Galaxy Collision and Gas Heating

A new deep and wide-field H-alpha image of the elliptical galaxy M86 shows a spectacular complex of warm gas filaments, providing striking evidence for a previously unsuspected high-speed collision between M86 and the disturbed spiral NGC 4438. These two colliding galaxies are located in the Virgo cluster, which is the nearest galaxy cluster to Earth. This new image thus shows astronomers the nearest example of a recent collision between a large elliptical and large spiral galaxy. Together with other data, the image suggests that collisions can heat the gas in ellipticals and suppress star formation.

The imaging data was taken with the MOSAIC imager on the Kitt Peak Mayall 4-meter telescope by Tomer Tal, GRD '12 and Prof. Jeff Kenney, along with Hugh Crowl, '06

PhD, WIYN Director George Jacoby, and John Feldmeier. The beautiful image was produced by Tal. A paper on this work will be published shortly in the *Astrophysical Journal Letters*.

Although gas had been previously seen around both galaxies, the connection between them could only be seen for the first time from this image, thanks to its depth and large field of view. The new image shows faint H-alpha emission (seen in red in the accompanying image) directly connecting the two galaxies.

Spectroscopy of selected regions, obtained with the Sparsepak Inte-

gral Field Unit on the WIYN telescope (*see article, p.11*), supports the collision scenario by showing a fairly smooth velocity gradient along the H-alpha filaments between the galaxies.

Kenney and other astronomers have previously written papers suggesting that the disturbed spiral NGC 4438 collided with the small S0 galaxy NGC 4435, which is very close to it on

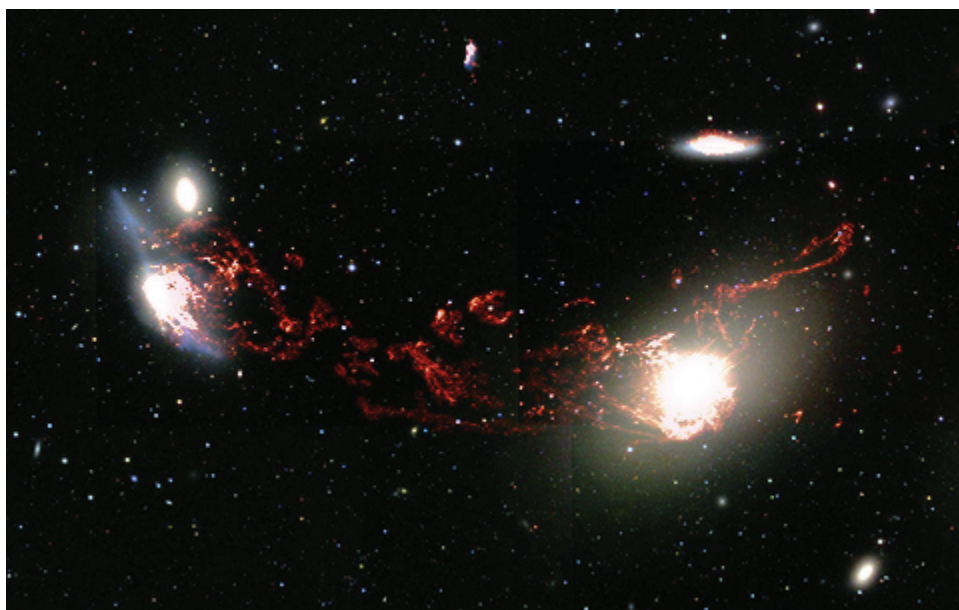
The result of the data gleaned by the image is significant in 2 ways. First, this is some of the clearest evidence for a high-speed collision between large galaxies, which is an important process for transforming galaxies in clusters. The collision has strongly disturbed the stellar disk of the spiral and removed most of the star-forming gas, thereby quenching star formation. Second, it shows that collisions can

heat the gas in elliptical galaxies.

A current mystery is why elliptical galaxies, the biggest galaxies in the universe, stop turning their gas into stars. Something is needed to heat up the gas so it doesn't cool and form stars. A number of recent studies suggest that energy from active galactic nuclei associated with nuclear black holes may do this, but this

new image shows that gravitational interactions may also be important.

While not many galaxies have such extreme collisions as M86, most galaxies experience minor mergers and gas accretion events, and these may play a role in heating the galaxy's gas. These more common but modest events are very hard to study, since their observational signatures are weak. But the same physical processes occur in both strong and weak encounters, and by studying the observable effects in extreme cases like M86 we can learn the role of gravitational interactions in the heating of galaxy gas.



H-alpha emission (red) showing warm gas on optical (3-color) image showing starlight. The elliptical galaxy M86 is to the right, and its collision partner, the disturbed spiral NGC 4438, is to the left. Photo by Tomer Tal & Jeff Kenney, NOAO and SDSS.

the sky. But NGC 4435 has a much higher line-of-sight velocity than NGC 4438, and appears undisturbed. The H-alpha image reveals the true collision to be between M86 and NGC 4438.

Like most elliptical galaxies, most of the gas in M86 is hot and emits X-rays. The X-ray distribution in M86 is irregular and sports a long plume which has previously been interpreted as a tail of gas that is being stripped by ram pressure as M86 falls into the intracluster medium of the Virgo cluster. The new H-alpha image suggests that most of the disturbances to the ISM of M86 are instead due to the collision.

YALE ASTRONOMY IN THE NEWS

Astronomy department participates in Open Yale Courses Initiative

The Yale astronomy department is one of the first departments at Yale to host a class on Open Yale Courses, a new initiative at Yale that has been made possible by a grant for Open Educational Resources (OER) from the William and Flora Hewlett Foundation in Menlo Park, CA.

Open Yale Courses are courses, usually taught to students at Yale by Yale professors and scholars, that have been made available to the general public without a fee via the Internet. The online course websites include lectures and other materials, produced by the Yale Center for Media and Instructional Innovation (CMI2).

The courses span the full range of liberal arts disciplines, including humanities, social sciences, and physical and biological sciences.

The class offered by the astronomy department on Open Yale Courses is ASTR 160, Frontiers and Controversies in Astrophysics, taught by Professor Charles Bailyn. Dr. Bailyn's twice weekly 50-minute lectures can be read as an html document, listened to as an MP3 or viewed via Flash or Quicktime. Supplementary materials are also available on the site.

Because the open courses are on the Internet as a snapshot of Yale courses, no enrollment is needed and students can learn the materials at their own pace. But this also means that Internet students neither interact with Yale professors nor obtain Yale course credit for taking the classes.

To take Dr. Bailyn's class, or to find out more information about any of the classes, please see: <http://oyc.yale.edu/>.



Dr. Bailyn teaching his open course.

Asteroid named after Yale Astronomy Department Researcher

The International Astronomical Union (IAU) has named an asteroid GIRARD after Dr. Terry Girard, Research Scientist at the astronomy department at Yale, in honor of his numerous and significant contributions to Astrometry and the Southern Proper Motion survey.



The asteroid, formerly known as 10450 and 1967 JQ, is a main-belt asteroid that was discovered in 1967

by C. Cesco and A. Klemola at the observatory in El Leoncito, Argentina. It is about 10 km in diameter.

The IAU has standardized the names of constellations since its inception in the early twentieth century, and, more recently, the names of other astronomical objects and features.

When a minor planet is discovered, it is assigned a provisional name according to a formula developed by the Minor Planet Center (MPC), such as "1967 JQ". When the planet has been observed for some time and its position has been determined to be predictable into the future, the minor planet is assigned a permanent number by the MPC, such as 10450.

The discoverer of the planet may choose a name for the planet at this point if he so desires, according to the rules set forth by the IAU, for a period of ten years, after which anyone may make a suggestion. The suggestions are vetted through a committee, who determines whether the name is suitable and follows the IAU naming rules.

Dr. Girard has worked as a Research Scientist at Yale since 1985. His current research is with the the Yale/San Juan Southern Proper Motion program at the South Galactic Pole.

Yale astronomy department members Dr. David Rabinowitz, B.S. '83, Dr. Dorrit Hoffleit (*see obituary, p.15*) and Dr. William van Altena (*see article, p.13*) have also had minor planets named after them.

Yale & Chile

The Departments of Astronomy at Yale University and the University of Chile (U. de Chile, also known as Calán) have had a Joint Program in Research and Education since 1999. The program began when the Fundación Andes, a private South American foundation interested in strengthening science and education in Chile, sought a North American institution to partner with the Astronomy Dept at U. de Chile in developing their graduate program. They chose Yale as a prominent, yet modest-sized department with a strong theory program; experience with astronomy in South America; and interest in access to Chilean telescopes. The program has evolved over the years, but continues to benefit the faculty, postdocs and students from both departments in multiple ways. Successes of the program include many scientific publications from the Joint Research Program and significant recognition for both departments throughout North and South America.

In the educational program there are opportunities for graduate students from both departments. Graduate students from U. de Chile can spend anywhere from six months to two years at Yale taking graduate classes or completing research projects. Over the last eight years, ten students from U. de Chile have spent time at Yale, and three of them completed PhDs which were supervised by Yale faculty. Graduate students from Yale can get access to Chilean telescope time if they spend at least nine months in Chile.

The Joint Research Program consists of projects designed and executed by members of both departments, including faculty, post-docs and students. Joint Program Postdoctoral Fellows play an important role, and they may spend part of their time at Calán and part at Yale. Participants in these projects have access to telescope time available to both institutions, including the Chilean share of telescope facilities located in Chile. Thus, joint projects have access to telescopes operated by the European Southern Observatory (including the 8.4m VLT telescopes), the Las Campanas Observatory (including the twin Magellan Telescopes), the Cerro Tololo Interamerican Observatory, and the Gemini Observatory. The Atacama Large Millimeter Array, which is currently under construction, will also be available to these joint projects. The Yale/Chile Joint Projects can also make use of Yale facilities, such as the WIYN and SMARTS telescopes (*see pp 10-11 for more information*).

One of the key projects of the Joint Research Program, which includes several other universities as well, is the Mul-

tiwavelength Survey by Yale-Chile (MUSYC). The survey comprises deep optical and near-infrared imaging of four Southern and equatorial fields (primarily using the Blanco 4m telescope at CTIO), followed by spectroscopy with Magellan, the Very Large Telescope, and Gemini. Pieter van Dokkum of Yale and Eric Gawiser of Rutgers (formerly of Yale) serve as the PIs for the project.

Other approved projects are: Studies of Local Group Galaxies, which has undertaken several separate but related investigations on the approximately 40 galaxies in the Local Group in order to learn more information about the evolution of galaxies; and Studies of Star Formation and Molecular Clouds, with additional projects expected to be authorized as the collaboration continues.

From May 19-20, 2008, the members of the Joint Program came to Yale for a two day conference on astronomy at Yale and at Chile. Participants discussed the respective departments, MUSYC, science undertaken by the participants, and the future of the Joint Program.

From 1999-2006 the program was jointly funded by Yale, U. de Chile, and Fundación Andes. In 2006 Fundación Andes went out of existence, although there are some residual Andes funds remaining for Chilean students to spend time in New Haven. In 2006 Yale University agreed to support a 3-year renewal (2006-9) for \$500K to supplement the residual Andes funding. Yale now funds half-support for 2 postdocs, and travel for all astronomers to the annual joint meetings and for students from either institution to the other for observing or scientific collaborations. Yale provides salary support to U. de Chile faculty who spend sabbatical time at Yale.

Yale also supports an undergraduate summer course in Santiago, Chile. Below is a picture of the participants of the 2008 program. (*See article, p.9, for more information*.)

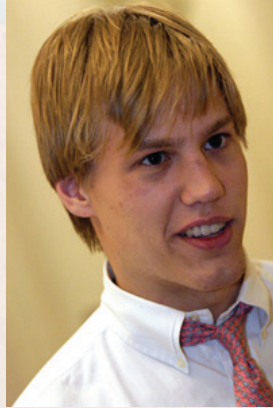


PABLO MADARIAGA

Participants of the 2008 Yale-in-Chile Summer Course along with administrators from U. De Chile. Professor Maza, who taught the course, is pictured on the right.

A Look at The Yale-In-Chile Summer Course

For the second summer of its existence, six students from Yale travelled to Santiago, Chile to complete the six-week undergraduate summer course taught by Professor Jose Maza from the University of Chile (U. de Chile) called "Introduction to Observational Astrophysics."



van Nispen, Naarendorp and Potter

The course, made possible by the collaboration of Yale University and the U. de Chile, had five weeks of lecture classes and observing laboratory exercises. The sixth week was spent carrying out observations at Cerro Calan and Cerro Tololo Observatories and visiting San Pedro de Atacama in order to see the Atacama Large Millimeter Array (ALMA). The program also included extracurricular activities, such as travels through Santiago, Valparaíso and Viña, and a concert by the Symphonic Orchestra of Chile.

The course is available to Yale students (and non-Yale students if there is space) who have completed an introductory Physics class (Physics 180 or 200 or 260) and are interested in science. There is no mandate that the students be astronomers or that they have even taken any astronomy courses.

Professor Maza spent a sabbatical at Yale in 2002 and taught one of Yale's introductory astronomy courses at that time. Of the summer course, Maza said, "For me it has been tremendously gratifying. Because the course was very small and yet the *chicos* were motivated by the material, I felt an interaction with them that was very positive. Therefore, it made me more motivated to do the classes."

Rocío Duque, the Assistant Director of Student Affairs of the Faculty of Physical Sciences and Mathematics (FCFM) for U. de Chile, emphasized the importance of internationalizing even more of the programs of the University of Chile because, as he said, "our students need to have a vision of the world that goes beyond the frontiers that they know."

"We hope we can enhance our capability to be able to send students to foreign places, but at this time we can bring students [who] can show us what there is outside, [and] this benefits us greatly," Duque continued.

Nicolaas van Nispen, a student in the program said, "A professor at my school. . . told me about the program. I said to him that I would like to work with him. . . at Yale [for

the summer], but he told me, 'no, you should go to Chile first, [and] take Professor Maza's course, because he is a great professor, [and] he knows a lot about everything,. But above all, you should go to Chile because it is a very important place for astronomy.'"

"It has been sensational. . . not only exploring the skies, but also getting to know Chile. . . I have not yet decided what I am going to study, because I am in my second year, but I am interested in the sciences. Currently, I am learning physics [and] astronomy. I would like to return to Chile, in order to return to see the stars with the eyes of the giants [telescopes] at the observatories," he concluded.

Grant Potter, another student, explained that he studies astronomy and physics at Yale, where his academic advisor told him about this program in Chile.

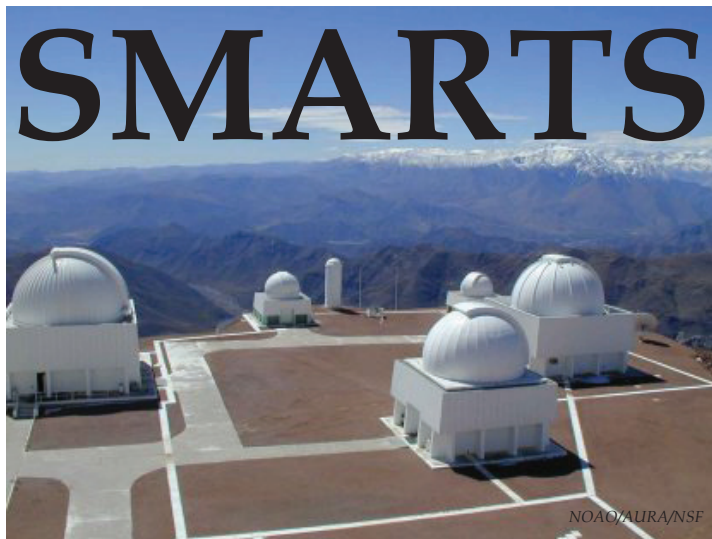
"At Yale University, the idea exists that you have to take advantage of your summers. If you go home and sleep the whole day, it is seen as a waste of time. Therefore, I wanted to do something that is good for my future," Potter said.

"I would love to return. I don't know what the future will grant me, I would like to study medicine, but I also like astronomy. It is one of my passions and if I am given the opportunity to return, I will take it. I would love to return to Santiago, [either] to work in the University or to travel to the observatory in the north," he said.

For Natasja Naarendorp, the people that participated in the program "made the difference". She said "It is the people that I will remember for the rest of my life... I learned about friendship, about sharing with people, how to live in a house [together with them] and to care for them."

This article incorporated text from Marco Antonio Braghetto, translated from the Spanish by Victoria Leigh Gardner. The photographs are by Pablo Madariaga.

Chile & Yale



SMARTS is a consortium of institutions, including Yale, and individuals that operate a series of four small telescopes at the Cerro Tololo Interamerican Observatory (CTIO) in the foothills of the Chilean Andes. Dr. Charles Bailyn of the Yale astronomy department serves as the Principal Investigator of SMARTS.

Currently, SMARTS has a 1.5m, a 1.3m, a 1.0m and a 0.9m telescope for use by the institutions. The 1.3m is queue-scheduled at Yale by Michelle Buxton. Data processing and distribution, also centered at Yale, are managed by Suzanne Tourtellote.

Six PhD Theses at Yale have been written using SMARTS data and many more student and faculty publications have used SMARTS. From 2006-2008, 78 refereed papers were published using SMARTS data, 15 of which were by Yale authors.

Please see <http://www.astro.yale.edu/smarts> for more information.

SMARTS Optical/IR Observations of LAT Monitored Blazars

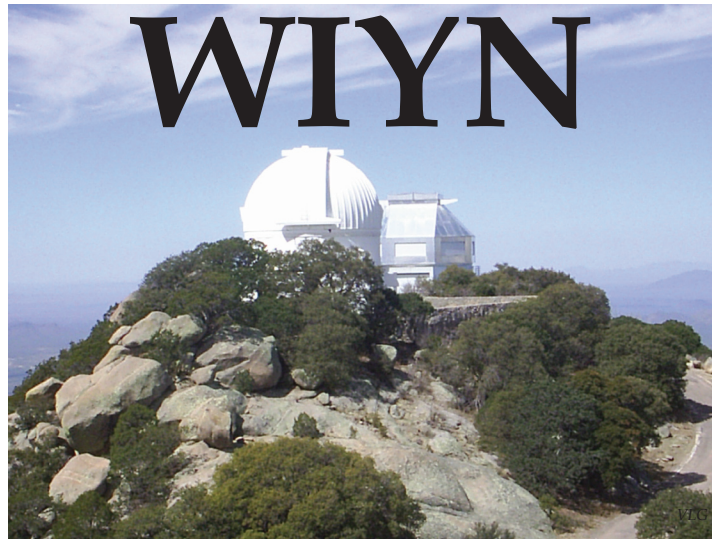
When the Gamma-ray Large Area Space Telescope (GLAST) successfully launched into space on June 11, 2008, a group of Yale astronomy department members cheered. Yale professors Charles Bailyn, '81 BS, Paolo Coppi, and Meg Urry; Yale research assistant Michelle Buxton; and Yale students Jedidah Isler, '13 GRD and Allison Kaptur, YC '09; along with Laura Maraschi from Brera Observatory and Giovanni Fossati from Rice University can now begin a project to combine optical and infrared data from the Small and Moderate Aperture Research Telescope System (SMARTS) at Cerro Tololo Interamerican Observatory (CTIO) in Chile with gamma-ray data from the Large Area Telescope (LAT) on GLAST in order to learn more about certain targeted blazars.

This program will use ~700 hours per year on the 1.0, 1.3 and 1.5-meter telescopes operated by SMARTS in order to obtain data on twelve blazars that are also being monitored by LAT.

The data generated by this project will be used to study the relationship between the emission peak in optical/IR bandpasses and the public GLAST gamma-ray emission. Data and results from the SMARTS telescopes will be made public within 24-48 hours. Data and more information can be found at: <http://www.astro.yale.edu/smarts/glast/>



An artist's drawing of the GLAST spacecraft in space.

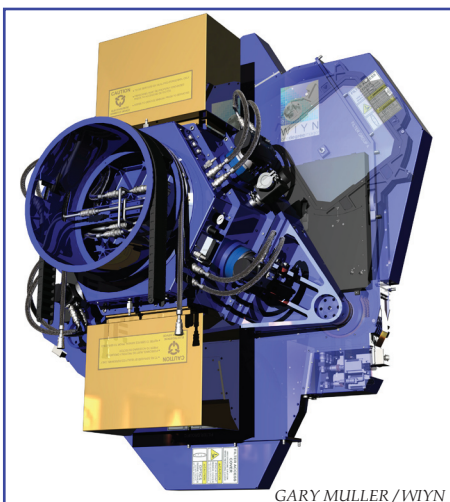


WIYN (<http://www.wiyn.org>) is a consortium of four partners, The University of Wisconsin, Indiana University, Yale University and NOAO, that owns a 3.5-meter optical telescope on Kitt Peak mountain near Tucson, Arizona. This public-private partnership, begun in 1994, was one of the first such partnerships for telescope ownership, and continues to act as a model for other consortia. Dr. Charles Bailyn of the Yale astronomy department currently serves as the president of the WIYN Board.

The WIYN telescope is one of the best imaging telescopes in the world. Its modern instrumentation includes a CCD camera with a 10 arcminute field of view (Mini-Mosaic or OPTIC), an infrared imager with tip-tilt correction (WHIRC), and a bench spectrograph which is fed by fibers from either a multi-object, fiber-positioning robot (Hydra) or an integral field unit for studies of extended objects (SparsePak).

Some exciting things have been happening in the past year at WIYN, including finishing instrumentation upgrades, such as the Bench spectrograph (the new collimator, CCD and VPH gratings will improve throughput by factors of 1.5 to 3) and working on future instruments such as the One Degree Imager (ODI, *see below for more information*) and the WIYN High Resolution Infrared Camera (WHIRC), which has a modest field of view but high resolution with the WIYN Tip-Tilt Module (WTTM) enabled and several narrowband filters available. Perhaps the biggest change for WIYN this year has been the departure of the first WIYN Director, Dr. George Jacoby and the advent of the second, Dr. Pierre Martin, formerly of the Canada-France Hawaii Telescope (CFHT).

Yale continues to actively use WIYN as one of its primary telescopes, especially for students. Seven Yale PhD theses and 53 refereed journal papers by Yale authors have been published with data taken from the WIYN observatory. Among the PhD projects carried out are studies of the stellar populations of nearby dwarf galaxies and studies of the kinematics and stellar populations of environmentally disturbed cluster galaxies.



GARY MULLER / WIYN

The award-winning design of ODI optics.

ODI is coming! Thus says the bumper sticker created by Gary Muller and Dr. Steve Howell at WIYN. ODI, or the One Degree Imager, is a 32K x 32K (1 Gigapixel!) CCD imager being built for the WIYN 3.5m telescope that fully utilizes both the telescope's one degree field of view and its excellent image quality. The instrument is expected to be available for science in mid-2010.

ODI will use a new detector technology called Orthogonal Transfer Array (OTA) CCDs. Each OTA has 64 independent CCDs which, by being able to shift charge in all directions, allows for an active tip-tilt image motion correction over the entire field of view. With this new technology, the already excellent image quality that the WIYN telescope provides will be enhanced so that WIYN will remain at the forefront of mid-size telescope imaging, especially for wide-field surveys such as the Yale-ODI survey which plans to do surveys of galactic structure, high redshift galaxies and transient objects. The new technology is expected to improve resolution by 0.1 to 0.2 arcseconds in good conditions and we expect 0.3 to 0.5 arcseconds resolution a significant fraction of the time.

ODI is funded by the WIYN partners and the National Science Foundation.



P * E * O

New Faculty



Hectór Arce
Assistant Professor

Originally from San Juan, P. R., Dr. Arce studies the formation of stars and the physical and chemical processes in the interstellar medium. His research focuses on observations of the gas and dust in star-forming regions. He is particularly interested in outflows from young stars, their role in the star formation process, and how they affect the physical and chemical

properties of the surrounding environment. He is also interested in molecular cloud structure, interstellar dust, and protoplanetary disks.

Dr. Arce received his PhD in astronomy at Harvard and his BA in physics from Cornell. He was a postdoc at Caltech in the OVRO millimeter group and then a NSF Astronomy and Astrophysics postdoctoral fellow in the Department of Astrophysics at AMNH. During this time, he worked with the Hayden Astrophysics Research and Enrichment program, a program that provides academic support and growth for New York City public school students from low-income communities, advising student research and creating astrophysics and computer programming curriculums.

Dr. Arce enjoys salsa and Latin jazz and will make his fourth attempt to get an official number to run the New York City marathon this year.

Marla Geha
Assistant Professor

As an observational astronomer, Dr. Geha is primarily interested in the formation, evolution and destruction of dwarf galaxies. Her current work includes observations of ultra-faint galaxies recently discovered in the Local Group. These objects are the least-massive and most dark-matter dominated galaxies in the known Universe, providing significant constraints on both galaxy formation processes and cosmology.



Dr. Geha received her PhD in Astronomy and Astrophysics from the University of California at Santa Cruz, her MS in Astronomy from New Mexico State University and her BS in Applied and Engineering Physics, Cornell University. She was a Hubble Postdoctoral Fellow at the Carnegie Observatories in Pasadena, CA and most recently was a Plaskett Fellow at HIA/DAO. She is excited about the recent publication of her fiancée, Matthew Polly's, new book, *American Shaolin*, which has become a national best-seller.

Daisuke Nagai
Assistant Professor

Dr. Nagai works in the area of theoretical and computational cosmology and astrophysics that are closely connected to experiments and observations. His current research interests include the large-scale structure of the Universe, clusters of galaxies, galaxy formation and evolution, dark energy, dark matter, high-energy astrophysics, and high-performance computing.



Dr. Nagai earned his PhD and MS in Astronomy and Astrophysics from the University of Chicago and his BS in Physics and Mathematics from the University of Michigan. Before joining the department he was a Sherman Fairchild Postdoctoral Scholar in Physics at California Institute of Technology. He also was a NASA Graduate Student Researchers Program Fellow for several years.

Dr. Nagai is a Referee for several publications, including the *Astrophysical Journal*, *Astronomy & Astrophysics* and *Monthly Notices of the Royal Astronomical Society*. He also is a Reviewer for NSF, NASA and NWO and a Panelist for the International X-ray Observatory (formerly known as NASA Constellation-X Mission)

Dr. Nagai says, "People usually have a hard time pronouncing my name. When I was a grad student, an eminent scientist in the field once referred to me as "Chicago Japanese" at some international conference.. Thanks to the Boston Red Sox pitcher, Daisuke Matsuzaka, everyone can say my name "Dice-K" around here!"

* P * L * E



Retiring Faculty



William van Altena
Professor of Astronomy,
Emeritus

On January 1, 2007, Dr. William van Altena retired from 33 years of service as an Astronomy professor at Yale, but he still remains active in the astronomical community, at Yale and at-large. In fact, he has been recently elected Vice Chair of the AAS' Division of Dynamical Astronomy and is currently editing a text for Cambridge Uni-

versity Press called *Introduction to Astrometry and Relativistic Celestial Mechanics*, due to be published in 2009.

Dr. van Altena received both his B.A. (1962) and PhD (1966) degrees in Astronomy from the University of California at Berkeley. His PhD research involved a study of the membership and characteristics of the nearest populous star cluster, the Hyades.

In 1972, after having been an Instructor of Astronomy for the University of Chicago, Dr. van Altena became a tenured Associate Professor of Astronomy at the University of Chicago and director of Chicago's Yerkes Observatory in Williams Bay, Wisconsin.

Shortly thereafter, van Altena was lured to Yale to become the President of the Yale Southern Observatory, Inc. in 1974 and the Chair of the Astronomy department in 1975. Van Altena remained Chair until 1981, and resumed the position for a short while during the Fall term of 2002.

While at Yale, in addition to performing research and teaching courses in introductory astronomy, astronomical observing, and astrometry, Dr. van Altena managed to find time to serve Yale on various committees, including those for the Division of Physical Sciences and Engineering, the Junior Year Abroad Committee, and the Teaching and Learning Committee, chairing the latter for several years. He served on the WIYN Board of Directors for many years and was its president from 1996 through 1999.

Dr. van Altena has also served on many committees of the American Astronomical Society and the Space Telescope Science Institute, including the NASA Study Panel that

recommended establishing the STScI. van Altena served as both Vice President and President of the International Astronomical Union's Commission 24 on Photographic Astrometry from 1986 through 1991. He led the Hubble Space Telescope's Astrometry Instrument Definition Team from 1972-1977 and was a member of the HST Astrometry Science Team from 1978-2000. He is a Fellow of the AAAS, a Corresponding Member of the Barcelona (Spain) Academy of Arts and Sciences and has been a Visiting Professor at the Vatican Observatory (1978), the Chinese Academy of Sciences (1991), the University of Barcelona (1992) and the National Astronomical Observatory of Japan (1995).

Dr. van Altena currently uses various facilities in his astrometric research including the Yale Southern Observatory, the Hubble Space Telescope and the WIYN telescope to determine distances and motions of stars, the positions and motions of near-earth asteroids, binary stars, star clusters and the structure of our Milky Way galaxy. His current research is centered on the Southern Proper Motion survey, which will permit a detailed investigation of the kinematical structure of the Milky Way in the Southern Hemisphere, as well as using the WIYN telescope's new high technology cameras to study galaxy remnants that are merging with the Milky Way.

In his free time, he enjoys game fishing in Argentina.

**"Stars In Motion: A Symposium
in Honor of Bill van Altena"
September 20-21, 2008
Yale University, New Haven, Connecticut**

The Yale Astronomy Department held a weekend symposium at Yale to honor the career of Bill van Altena on September 20th and 21st, 2008. Invited speakers and a number of contributed talks covered topics to which Bill has devoted his professional life: astrometry (including the future of astrometry), fundamental stellar properties, star clusters, stellar kinematics and galactic structure. A full day of sessions on Saturday, September 20th was followed by a banquet at the Omni Hotel in New Haven that evening. The symposium then continued with a half day of sessions on Sunday, September 21st. This symposium was both a memorable celebration of Bill's career as well as scientifically interesting and we are grateful to all who worked hard to make it successful.

For more information, please see:
<http://www.astro.yale.edu/wvafest>

Charles Baldner, '11 GRD won a 2008 NASA Earth and Space Science Fellowship for his research.

Bethany Cobb, '08 PhD won a 2008 NSF Astronomy and Astrophysics Postdoctoral Fellowship. (See also p. 17.)

David H. DeVorkin, '70 MPhil, '72 MS was awarded the 2008 LeRoy E. Doggett Prize for Historical Astronomy by the American Astronomical Society (AAS) for his "seminal work in illuminating the origins and development of modern astrophysics and the origins of the space sciences during the twentieth century". DeVorkin currently serves as the curator of history and astronomy and the space sciences at the Smithsonian Institution's National Air and Space Museum.

Jenny E. Greene '00 BS received the 2008 Annie Jump Cannon Award from the AAS, given annually to a female astronomer residing in North America who is within five years of receiving a PhD during the year of the award. Greene is currently at the Harvard-Smithsonian Center for Astrophysics. As stated in the AAS newsletter, "with techniques and methods that she innovated, she has discovered numerous intermediate-mass black holes with masses of 10,000-100,000 solar masses. Her work put a firm lower limit on the space density of intermediate black holes."

Jeffrey Kenney, Chairman of the Yale University Astronomy Department, was named the 2007 recipient of Yale College's Conde Award for teaching excellence in physics, applied physics and astronomy.

Stephen Sackett, '69 BS (physics) received the 2008 Jackson-Gwilt Medal from the Royal Astronomical Society of the United Kingdom for his development of astronomical instrumentation and telescopes. Sackett has designed and built instruments for the Magellan 6.5m and du Pont telescopes at Las Campanas, Chile. He is also instrumental on the Giant Magellan Telescope (GMT) project.

Peter B. Stetson '75 MS, '79 PhD, was awarded the 2008 George Van Biesbroeck prize by the American Astronomical Society. The prize honors an individual "for long-term extraordinary or unselfish service to astronomy". Dr. Stetson was recognized for "his life-long efforts to enable, counsel, and help others do effective research with the tools that he has developed, specifically the DAOPHOT family of reduction programs for the analysis of astronomical images".

Ezequiel Treister '02 MS, '03 MPhil, '05 PhD (Yale/U.de Chile Joint Graduate Program, C.M. Urry, advisor), was awarded a 2008 Chandra Fellowship.

C. Megan Urry, '01 MAH, Israel Munson Professor of Physics and Astronomy has been named chair of the Department of Physics for a term of three years, effective July 1, 2007. In addition, she was one of seven Yale faculty members to be elected to the Connecticut Academy of Science and Engineering in 2007.

Jong-Hak Woo, '05 PhD was awarded a 2008 Hubble Fellowship.

The **Dirk Brouwer Memorial Prize** is awarded to a student in the department for a contribution of unusual merit to any branch of astronomy. In 2008, the prize was awarded to two students:

***Hugh H. Crowl, '01 MS, '03 MPhil, '06 PhD** won for his dissertation:
Galaxy transformation in the Virgo cluster: gas stripping and stellar population evolution.

***Ryan S. Quadri, '02 MS, '04 MPhil, '07 PhD** won for his dissertation:
Clustering of massive galaxies in the early Universe (see p. 17 for more information).



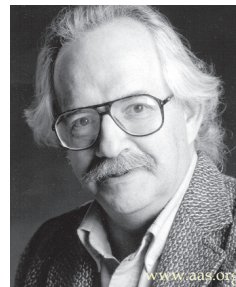
JAMES PORTO



PHOTO: AAS/WWW



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Pictured from left to right: Meg Urry, Stephen Sackett, Charles Baldner, David DeVorkin, Peter Stetson

Remembering Dorrit

(12 March 1907 - 9 April 2007)



CHIA-HSIEN LIN

Dr. Ellen Dorrit Hoffleit was a brilliant spark of light who brought much to the science of astronomy. She was born in Florence, Alabama in 1907 and, shortly after celebrating her 100th birthday at a luncheon attended by 94 of her friends and colleagues, she passed away due to complications from cancer at her apartment in New Haven, CT.

Dr. Hoffleit earned her PhD in astronomy at Radcliffe in 1938 and stayed at Harvard, first as a research assistant at the Harvard College Observatory and then as an astronomer, until she came to Yale in 1956 as a senior research astronomer. Dr. Hoffleit retired from Yale in 1975, but stayed active there as an *Emeritus*.

Dr. Hoffleit's research varied throughout her long career, including topics related to meteors, spectroscopic parallaxes, variable stars, and astrometry. She directed the Maria Mitchell Observatory on Nantucket Island from 1957 to 1978, wrote an autobiography called *Misfortunes as Blessings in Disguise: The Story of My Life*, and is most noted for her work as the author of the *Bright Star Catalogue* and as co-author of *The General Catalogue of Trigonometric Stellar Parallaxes*. She also wrote *Astronomy at Yale: 1701-1968*.

In 1987, in honour of her 80th birthday and her vast years of work in astronomy, the International Astronomical Union named the minor planet 3416 "Dorrit". According to an article by Michael Saladyga and Elizabeth Waagen of the AAVSO, Dr. Hoffleit once said, "I like to joke that [my] asteroid is where I shall go when I die, my celestial home!" Only the heavens know if she is there now.

The Hoffleit Centennial: A Year of Celebration, edited by *Emeritus* Professor of Physics and Astronomy A. G. Davis Philip of Union College, *Emeritus* Professor William F. van Altena of Yale (see also back cover) and Professor of Physics and Astronomy Rebecca Koopmann of Union College, was published by L. Davis Press in April 2008.

The publication compiles 27 papers and 5 poster papers, as well as pictures, from the Hoffleit Centennial celebratory conference, held at the Omni Hotel in New Haven near the Yale Campus on April 28-29, 2006.

The scientific talks focused on topics that were related to areas to which Hoffleit had contributed during her career, including: Women in Astronomy, Surveys, Catalogues, Databases and the Virtual observatory, The Solar System, Spectroscopy and Photometry, Education, and Variable Stars.

IN MEMORIAM



In Memoriam

Jin-Fuw Lee
April 15, 1948-
July 19, 2008

Jin-Fuw Lee passed away in July after a valiant six-year battle with cancer. Lee was born in China and grew up in Taiwan, graduating in Physics from the National Taiwan University. He received his PhD

in Astrophysics from Columbia and was a Post-Doctoral Fellow in the Yale Astrometry Group from 1980 to 1984. While at Yale, he made major contributions to the analysis of images measured on photographic plates and set the international standard for measurement precision that has not been exceeded some 25 years later. In 1984, Lee moved to the IBM Thomas J. Watson Research Center in Yorktown Heights, where he received achievement awards for his inventions and technical innovations. Lee was a very talented scientist and, above all, a kind and pleasant colleague.

In Memoriam

Adrianus (Andy) Antonius Disco
October 29, 1915-
July 14, 2008



Andy Disco passed away on Monday, July 14, 2008 at the age of 92. Disco was a key player in the development of Yale's Bethany Observatory (founded in 1957) and saw to its maintenance for many years. He also installed the Yale Southern Observatory's Double Astrograph at El Leoncito, Argentina and was a great help to all in the maintenance and improvements that were made to the telescope over the years. Disco will be remembered for his cheerful and positive outlook as well as for the ingenuity and quality of his instrumentation.

MORE PEOPLE



Jason Tumlinson was the first Gilbert and Jaylee Mead Postdoctoral Fellow of the Department of Physics and Yale Center for Astronomy and Astrophysics, from September 2005 until June 2008. He has accepted and begun a new position as an Astronomer at the Space Telescope Science Institute (STScI) in Baltimore, Maryland.

Before coming to Yale, Tumlinson obtained his BA in Physics from Rice University and his PhD in Astrophysical and Planetary Sciences from the University of Colorado-Boulder. He also served as the Edwin P. Hubble Scientist for the Department of Astronomy and Astrophysics at the University of Chicago from 2002 to 2005.

Tumlinson's research interests are in the first stars, galaxy formation, interstellar and intergalactic matter, and nucleosynthesis.

Outside of astronomy, Tumlinson enjoys kayaking and playing with his son, Owen.



Victoria Leigh Gardner
WIYN and SMARTS Coordinator

Miss Gardner works for both the WIYN and SMARTS organizations. She is responsible for coordinating the renewal of the WIYN consortium operating agreement, which includes providing guidance, process management and other support to the consortium as a whole. She is also responsible for coordinating the scientific and financial management of SMARTS and is currently the SMARTS webmaster. In addition, she has created the first astronomy department Alumni newsletter and a brochure for undergraduates. When not working at the astronomy department, she can be seen (and heard) singing opera.

New Department Staff

Theresa Pierson
Business Administrator

Mrs. Pierson has many responsibilities in the astronomy department. First, she maintains the budget for the department and monitors grant activity. Second, she is responsible for maintaining the facilities of the Astronomy department, a job that can range anywhere from hanging up a poster to renovating offices for new faculty. Third, she supervises several of the astronomy department staff members. She is also actively involved in the building of the new planetarium, due to be completed in January 2009. In her free time, Mrs. Pierson loves to read and swim. She also has a penchant for wolves.



Newsletter Editorial Staff

The Yale Astronomy Department Newsletter is to be published annually by the Astronomy Department and the Graduate School of Arts and Sciences.

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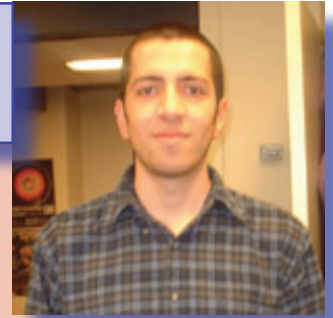
RECENT GRADUATES



Bethany Cobb
(’02 BA Williams College), ’03 MS, ’04 MPhil, ’08 PhD is now serving as a NSF Postdoctoral Fellow at UC Berkeley. Her dissertation was *Long-term observations of GRBs: the complex connection between GRBs and SNe*.

A gamma-ray burst (GRB) is a quick blast of high energy photons that is brilliant enough to be observed at extreme distances (many from distances more than half the universe from Earth). For her thesis, she observed the optical and infrared light that often accompanies these bursts using the SMARTS 1.3m telescope in Chile. She tracked how these bursts behave with time in an attempt to understand why these events occur. A leading theory suggests that one class of these bursts results from supernovae (SNe), which are the explosive deaths of special massive stars. She observed such SNe following two GRBs. However, her work, in conjunction with that by other groups, also suggests that the formation scenario for GRBs is more complex than previously believed.

Cobb’s advisor was Dr. Charles Bailyn ’81 BS, Thomas E. Donnelley Professor of Astronomy and Physics and the Director of Undergraduate Studies of the Yale astronomy department.



Ryan Quadri
(B.S. ’01 Harvey Mudd College), ’03 MS, ’04 MPhil, ’07 PhD, is currently a NOVA Postdoctoral Fellow at Leiden University in the Netherlands. His dissertation was *The Clustering of Massive Galaxies in the Early Universe*.

Until quite recently it was thought that the early universe was dominated by young, low-mass galaxies that were growing rapidly due to both star formation and mergers. But it is now becoming apparent that, even at these early times, a population of massive and comparatively evolved galaxies was already in place. For his thesis he collected and analyzed near-infrared data from the Multiwavelength Survey by Yale-Chile (MUSYC) in order to identify and study these massive galaxies, with a particular emphasis on understanding how these galaxies cluster together into groups. He found that these galaxies are very strongly clustered; in fact, the clustering is so strong that it is difficult to reconcile with what we expect for how galaxies and dark matter should cluster. The conflict may simply be the result of systematic errors in the data, or it may be telling us something more important. Fortunately, upcoming studies should help clarify the situation.

Quadri’s advisor was Dr. Pieter van Dokkum.

Eric Murphy
(BS ’02 Tufts University), ’03 MS, ’04 MPhil, ’07 PhD, is now a postdoctoral scholar at Caltech/Spitzer Science Center. His dissertation was: *Star Formation, Dust Heating, and Cosmic-Ray Electron Cooling: A Far-Infrared and Radio Study of Nearby Galaxies*.



For over 20 years astronomers have been puzzled about a surprisingly strong correlation between the radio and far-infrared continuum emission in galaxies. While both are apparently powered by massive star formation, the small scatter in the correlation has been a mystery, but offers great potential for understanding the behavior of different components of the interstellar medium, and the star formation histories of galaxies. Murphy gained new insight into the correlation by using new far-infrared data with excellent sensitivity and spatial resolution from the Spitzer Space Telescope. He compared the spatial distributions of far-infrared and radio continuum emission in 20 nearby galaxies and found a good spatial correlation. The inter-

pretation is that the far-infrared emission arises from dust heated by massive stars, and these same massive stars end their lives as supernovae, whose remnants accelerate Cosmic Ray (CR) electrons which emit synchrotron radio emission while traveling in a galaxy’s magnetic field. The radio emission is more “smeared out” than the far-infrared emission, because the CR electrons diffuse away from their acceleration sites. Murphy found that the CR electron diffusion lengths exhibit a strong correlation with the star formation rate, such that the diffusion lengths are shorter in galaxies with large star formation rates. This can only happen if the star formation in spirals is bursty. He also examined the correlation in cluster spirals, and found radio “deficit regions” along the outer edges of most galaxies, allowing him to characterize the direction and magnitude of ongoing ram pressure stripping.

Murphy’s advisors were Dr. George Helou from CalTech and Dr. Jeffrey Kenney from Yale.



ALUMNI

Morris S. Davis, '50 PhD writes, "After teaching continuously since 1970 in the Physics and Astronomy Department at the University of North Carolina, I retired in 1985 teaching half-time for three more years while continuing as Executive Editor of "Celestial Mechanics" for four years. In those last few years my astronomical colleagues, by dint of long and hard endeavor (from 1986 to 2004), established SOAR (Southern Observatory for Astrophysical Research), one of the leading international astronomical institutions. I have observed this evolution with great pride."

Douglas O'Handley, '67 PhD writes, "I retired from NASA in 1999. However I am not idle. NASA asked me to continue to run the summer NASA Ames Astrobiology Academy. I remain an adjunct professor at Santa Clara University, teaching Introduction to Space Science." He also enjoys returning to New Haven as a member of the Yale Graduate School Alumni Association Executive Committee.

Julian Palmore, '67 PhD, professor of mathematics at the University of Illinois at Urbana-Champaign, is teaching two classes this spring, a course in differential equations/dynamical systems and a course in mathematical methods in national security. His research is in discrete dynamical systems and national security issues of missile defense and emerging infectious diseases. For the past two years he served as director of the program in arms control, disarmament and international security at UIUC.

Jeffrey D. Rosendhal, '68 PhD writes, "Following my retirement from NASA in September 2004 (after more than 30 years at the Agency), I've been involved in a wide-ranging mix of activities that include consulting, writing, traveling, and catching up on years of sleep deprivation. In addition to having visited more than a dozen countries, I'm currently writing a book. In 2006, the Astronomical Society of the Pacific presented me with its Klumpke-Roberts Award for 'distinguished contributions to the public understanding and appreciation of astronomy.'

David A. Weintraub, '80 BS recently published a book (*see p. 20 for more info*). His daughter, Sarah Beth Weintraub, is now a freshman at Yale, in Timothy Dwight College.

James Mercer-Smith, '80 PhD has been a scientist at the Los Alamos National Laboratory since 1983. In November, he was made a Laboratory Fellow, a distinction based on technical achievement and reached by only about 1% of the scientists at Los Alamos. He served as the Senior Editor for Defense Research Review, a classified research journal from 1988 to 1990 and he has received multiple Department of Energy Nuclear Weapons Recognition of Excellence

Awards. Dr. Mercer-Smith has been featured in the books: *The Good Servant* by Janet Bailey and *The Secret Mesa* by Jo Ann Shroyer.

Ata Sarajedini, '86 BS, '92 PhD is currently an Associate Professor in the Department of Astronomy at the University of Florida. Ata writes, "my major research is in the area of resolved stellar populations in Local Group and nearby galaxies. My work was featured on the University of Florida web site in their 'spotlight' series available at:

<http://www.ufl.edu/spotlight/sarajedini.html>."

Michael West '87 PhD is currently Head of Science in Chile for ESO, where he leads an international team of 80 ESO astronomers, postdocs, and graduate students based in Santiago. Michael's current research interests include globular clusters as probes of galaxy formation and evolution, clusters of galaxies at low and high redshifts, and the large-scale structure of the universe. He is also active in public outreach, and currently heads a newly formed IAU working group on New Ways of Communicating Astronomy with the Public. He served as chief astronomy advisor for the Imiloa Astronomy Center of Hawaii, a \$28 million NASA-funded museum that weaves together astronomy and Hawaiian culture into a unique story of human exploration. In addition, he is author of a general interest book (*see p. 20 for more info*).

Edward Seidel, '87 MS, '88 MPhil, '88 PhD has recently been selected by the National Science Foundation (NSF) as its director of the Office of Cyberinfrastructure and will begin his term on September 1, 2008. The office awards grants to scientists and others who are involved with state-of-the-art information technology. Seidel will leave his position as Floating Point Systems Professor in the Louisiana State University (LSU) Departments of Physics and Astronomy and Computer Science and his directorship of the LSU Center for Computation and Technology in order to assume this new NSF position.

Adrian N. Daw '89 BS is currently a solar astrophysicist at Appalachian State University in North Carolina.

Andrew Lederman, '90 BS writes, "I'm in the Berkshire Mountains, working as a simple country advanced laparoscopic bariatric and gastrointestinal surgeon. I still have my hands in some academics and research relating to minimally invasive surgery and GI disease, and teach medical students and residents. My spare time is spent skiing with my kids. I occasionally get asked to teach astronomy in their classrooms, and it humbles me to see how much I've forgotten! Or how much has changed since I finished."



NEWS

Sydney Barnes '90 BS, '98 PhD is an astronomer at Lowell Observatory in Flagstaff, Arizona. Dr. Barnes and **Y.-C. Kim ('93 PhD)** have been working together this year on various aspects of stellar activity and rotation. Dr. Barnes has spent the past three years working on a method, now called 'gyrochronology,' of using the rotation periods and colors of stars in order to tell their ages. When not working, Drs. Barnes and Kim enjoy hiking the Grand Canyon.

John Gizis '92 BS was promoted to Associate Professor with tenure at the University of Delaware in 2007.

Andrew Cole '94 BS is a lecturer in the department of mathematics and physics at the University of Tasmania in Hobart, Australia, which has a very strong record in radio astronomy and in microlensing surveys for extrasolar planets. His most recent paper reported that 90% of the stars in the isolated dwarf irregular galaxy Leo A are younger than 7 billion years old. His time is divided between teaching, research, and efforts to upgrade the university's 1-metre telescope on Mt. Canopus, outside Hobart.

Britt Reichborn-Kjennerud '94 BA writes, "after teaching secondary school science for many years I started a Ph.D. in Physics at Columbia in 2003. I am working with Amber Miller on EBEX, a CMB Polarization experiment."

Douglas L. Tucker '94 PhD spent two years in a post-doctoral position at the Astrophysikalisches Institut Potsdam, working on the Las Campanas Redshift Survey (LCRS). Since 1996, he has been a member of the Experimental Astrophysics Group at Fermilab, where he has worked on Sloan Digital Sky Survey (SDSS) and, more recently, on the proposed Dark Energy Survey (DES) and the proposed Supernova Acceleration Probe (SNAP) JDEM mission. His primary area of work is in the area of photometric calibrations of large imaging surveys, and he has recently been named Calibration Scientist for the DES. His research interests range from photometric calibrations and star cluster photometry to high-redshift galaxies and large scale structure.

Jing Zhang '95 MS, '98 MPhil is a Database Administrator at Yale-New Haven Teachers Institute, which trains public school teachers by using Yale academic resources such as: faculty members, libraries, and classrooms. He writes, "Even though what I am doing is far from astronomy, I still pay special attention to the breaking news in astronomy."

Jerome A. Orosz, '96 PhD worked in postdoctoral positions at Penn State and at Utrecht University in the Netherlands. Since 2002, he has been on the faculty in the department of Astronomy at San Diego State University. He was recently promoted to Associate Professor with tenure.

Yas Hashimoto '95 MS, '95 MPhil, '98 PhD is now a SALT Astronomer at SAAO.

Alison Sills, '98 PhD is the Associate Dean of Science (Studies) and Associate Professor in the Department of Physics and Astronomy at McMaster University in Ontario, Canada.

Dimitri Veras, '01 BS graduated with his PhD from the Department of Astrophysical and Planetary Sciences at the University of Colorado at Boulder. He is now a Postdoctoral Researcher in the Department of Astronomy at the University of Florida. He studies the dynamics and evolution of extrasolar planetary systems, and a list of his publications can be found at <http://dimitriveras.com/>.

Daniel Kelly '03 BS writes, "after graduating in 2003, I joined Teach for America and have been teaching middle school science and math in public schools ever since. In Harlem, I started a baseball team at my school and helped coaches at other schools form their own teams. The league is entering its fourth season this year. Next year, I might accept a position teaching astronomy and/or physics at a public high school."

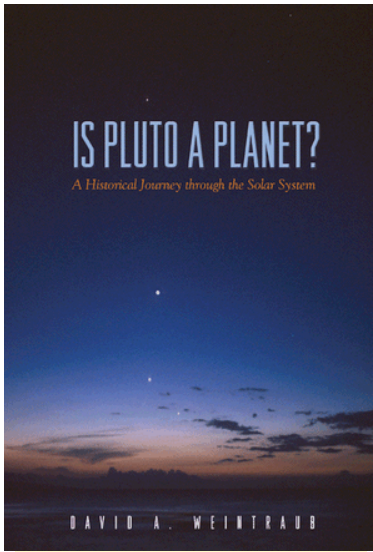
Meredith Hughes, '05 BS is currently a third year graduate student in the Harvard astronomy department, studying circumstellar disks using sub/millimeter interferometry. She also volunteers at the Boston Museum of Science and runs kids' nights at the Harvard-Smithsonian Center for Astrophysics. She has three publications on disk-related topics in various stages of completeness (one submitted, one accepted, one published). In her spare time she sings and directs outreach efforts for the Boston Choral Ensemble.

Jong-Hak Woo, '05 PhD writes, "Here at UC Santa Barbara, I am leading a challenging and important observational project using the Keck telescope and the Hubble Space Telescope to investigate how supermassive black holes and galaxies evolved together. I just got an offer for the Hubble Fellowship, the most prestigious fellowship for postdocs in Astronomy."

Kathy Kornei, '06 BS is working towards her Ph.D. in astronomy at UCLA with a research focus on the nuclear region of a local starburst galaxy in infrared light to discern stellar kinematics and excitation mechanisms. This work uses data obtained from the NASA Infrared Telescope Facility on Mauna Kea. She writes, "when I'm not doing astronomy, I enjoy the good Los Angeles weather by surfing" !

If you have news about yourself or others you would like to share, please E-mail it to astro.newsletter@yale.edu

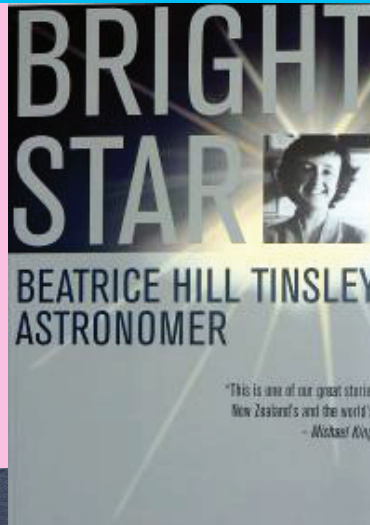
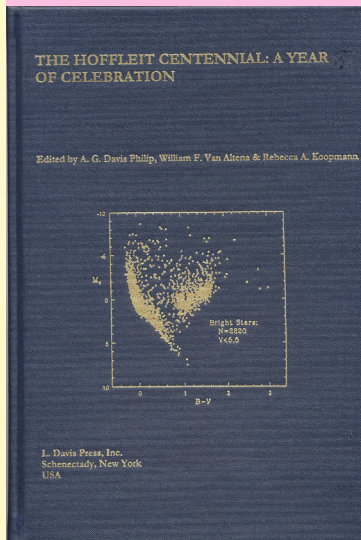
YALE ASTRONOMY BOOKS



David A. Weintraub '80 BS recently (Oct. 2006) published a book with Princeton University Press, entitled *Is Pluto a Planet? A Historical Journey through the Solar System*, which was nominated for the 2008 AAAS/Subaru SB&F Prize for Excellence in Science Books and which will be released in paperback in 2008.

<http://press.princeton.edu/titles/8247.html>

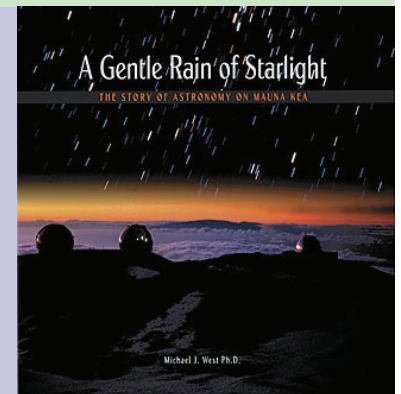
The Hoffleit Centennial: A Year of Celebration, edited by Professor of Physics and Astronomy A. G. Davis Philip, Professor William F. van Altena of Yale and Professor of Physics and Astronomy Rebecca Koopmann, was published by L. Davis Press in April 2008. (See also *obit*, p.15.) If you would like to order a copy of this book, please contact the department.



http://www.capecatelybooks.co.nz/index_files/Page689.html

Michael West '87 PhD published a book called *A Gentle Rain of Starlight: The Story of Astronomy on Mauna Kea*.

<http://astronomymaunakea.com/reviews.html>



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