



Department Report

INTRODUCTION

In addition to the usual extensive collaboration with other departments at the Adler on exhibits and programs (such as the Cyber Space website and Deep Space Adventure), the Astronomy Department celebrated a special landmark in the second quarter of 2008: the one year anniversary of the extremely successful "Astronomy Conversations" program.

Started in the spring of 2007, "Astronomy Conversations" brings staff astronomers and historians to the museum floor for informal conversations with and short presentations to our visitors. Held in the Space Visualization Lab, the program reached almost 15,000 visitors in the first year.

continued on page 4



Containing well over a trillion stars, the giant elliptical galaxy M87 dominates the Virgo Cluster of Galaxies. The inset better shows the powerful jet poking out from the center of this galaxy. The jet hints that M87 contains a supermassive Black Hole with about 1 billion solar masses crammed into an area only about the size of our solar system. M87 is about 60 million light years away from Earth and is high on the list of targets in the VERITAS search for gamma rays. Imaged from the Doane Observatory by Larry Ciupik.

Interview

DAVID STEELE, POST DOCTORAL FELLOW



Dr. Steele has been with the Adler for 4 years. Prior to the Adler he had experience as a neutrino astronomer. While he originally joined the Adler as an assistant exhibit developer for the Ice Cube exhibit, he soon joined the Adler's VERITAS research group

where he has played a key role. Dr. Steele's research centers on neutrino physics, high-energy gamma-ray astronomy and active galactic nuclei. He also has a keen interest in outreach and can be frequently found upstairs in the SVL discussing neutrinos, gamma rays and black holes with our public audience.

PF: Why astronomy?

DS: Actually, I'm an astrophysicist. These days, however, there's not too much difference between an astronomer and an astrophysicist since we are both interested in many of the same scientific problems.

I have been interested in astronomy and the vastness of space since I was a teen. I grew up in a rural environment where I could see lots of stars and even the Milky Way on a clear night. When I got a little older, I started to learn about such things as Einstein's theories of relativity and the "Big Bang" theory of how the Universe began. I was also very drawn to the scientific method itself.

As an undergraduate, I did an internship at Los Alamos National Laboratory where I worked on a neutrino experiment. My interest in neutrinos eventually led me to do my graduate research in neutrino astronomy using what is now known as the IceCube telescope at the South Pole in Antarctica. This is where I developed an interest in the specific kinds of objects I study today.

PF: What is out there that has captured your attention?

DS: I think my favorite phenomena involve black holes: places where there is so much gravity that the fabric of space-time is torn. Since airing a show about black holes for the past year or so here at the Adler, most of us by now are aware that there is a black hole at the center of our Milky Way galaxy with a mass of about 3 million times that of our sun. Indeed, we think that there are probably black holes at the centers of most galaxies.

continued on page 2

Interview: David Steele, Post Doctoral Research Fellow

continued from page 1

We also know that these “active galaxies” (or “active galactic nuclei”: AGN) emit gamma rays. Gamma radiation is invisible light at the most energetic end of the spectrum. The gamma radiation from an AGN is extremely variable. By studying the patterns of this variability, and variability at other wavelengths of emission, astronomers have come up with several theories to explain how they produce what we observe. Part of the focus of my research these days is aimed at refining and narrowing down the list of these possible theories through further observations.

PF: Would you explain, in lay terms, the VERITAS project?

DS: VERITAS stands for the “Very Energetic Radiation Imaging Telescope Array System”. Here “very energetic radiation” is just another term for gamma rays, so VERITAS is a ground-based gamma-ray telescope system. It consists of four telescopes, each one having a 12-meter compound primary mirror and a special fast camera. The telescopes were built and are operated by a collaboration of about 80 scientists from about a dozen institutions from across the globe, including our research group here at the Adler.

Gamma rays from celestial objects, fortunately for our health, don't actually make it through the Earth's atmosphere to reach the ground, but instead collide with air molecules about 20 km above our heads. When this happens, the energy carried by the gamma ray is converted into a shower of other energetic, electrically charged particles. This shower forms a long tube that, for a very short time, glows in blue and ultraviolet light. It is this fleeting blue light that the VERITAS telescopes detect with its very sensitive and fast cameras. With four telescopes we can make a stereo image of the particle shower and trace its path back to the place in the sky where the gamma ray came from. In time, we can measure enough showers to make gamma-ray images of the sources emitting them.

PF: Where do think the field will be 15 years from now?

DS: VERITAS is considered a third generation gamma-ray observatory. It took more than ten years from concept to actuality. This current generation of telescopes has more than doubled the catalog of known gamma-ray sources, some of which are not observed at any other wavelengths and we really don't know what they are! In 15 years we might see the next generation of telescopes in operation. So hopefully there we be many more sources to study, and perhaps we'll know more about those that are very mysterious to us today.

PF: And if it wasn't astronomy?

DS: I would probably be doing physics or some other kind of science. Recent results in evolutionary biology using molecular (DNA) techniques are very exciting to me. I also find the state of the art in human brain research using functional magnetic resonance imaging fascinating. I might even have become a

philosopher, but certainly not anything as practical as an engineer!

PF: You have an interesting sideline; do you care to elaborate on it?

DS: One thing I've known about myself for a long time is that I would be miserable without some sort of musical or artistic outlet, and I usually have some sort of project along those lines going in my free time. In the past I've dabbled in photography, painting, playing the piano and writing music. For the last several years I've been experimenting with electronic music as an amateur DJ. For those who don't often go to a dance club, DJ traditionalists (like myself) spin vinyl records (yes they still make them!) using two or more turntables and a mixer to create long, continuous pieces of music by combining the sounds on individual records. The technical aspects are actually more difficult to master than one might imagine, but there's nothing like the feeling of pulling off a tricky mix!



An astronomer inspects the lower quadrupod arm of T1, one of four telescopes of the VERITAS gamma-ray observatory located at Fred Lawrence Whipple Observatory in Arizona. Each telescope has 350 mirror segments forming a primary reflector 12 meters in diameter. Image credit: David Steele

PF: How long is your commute to work?

DS: This summer I've made biking my default mode of transportation to and from work. Depending on the wind speed, it takes me 30 to 40 minutes to reach the Adler. The same trip by public transportation takes 45 minutes to an hour.

PF: What do like most about your job?

DS: There's nothing more exciting than discovering something new about the objects we study, but that kind of excitement doesn't come along very often. Progress at the cutting edge of science today requires an enormous effort, and the feeling of reward is most often shared among dozens if not hundreds of scientists working together on a project. I often tell students that the most important quality of a scientist is dedication and the capacity to persevere.

continued on page 8

Project Notes

GUSTAV HOLST'S THE PLANETS

The upcoming concert of *The Planets* at the Pritzker Pavillion in Millennium Park on August 22 marks the end of a three-year collaboration between the Chicago Sinfonietta and the Adler Planetarium. In 2005, as part of a Guthman Foundation funded grant, Maestro Paul Freeman asked the Adler to provide a “visual backdrop” for two performances of the popular orchestral suite by Gustav Holst. Because of his interests in classical music, astronomy and the graphic arts Dr. José Francisco Salgado was asked to produce the backdrop for these concerts.

Though a simple slide presentation would have sufficed, Dr. Salgado thought that a set of high-definition (HD) videos would be innovative and challenging. Featuring not only awe-inspiring and unfamiliar images of the planets and the cosmos, but also movies, animations, and works on paper from the Adler historical collections, a video suite would be the perfect medium. Furthermore, these videos could follow the tone and tempo of the music and, with the conductor's approval, even be synchronized with the changes in the music.

The seven movements of Holst's work are based on the mythology associated with each of the planets. Dr. Salgado's video suite, however, is centered on our scientific understanding of these worlds. Following the music, the viewer is taken on a glorious tour of the solar system, excluding only the Earth itself. Pluto, which had not been discovered at the of Holst composed the piece, is also excluded.

After many months of researching the NASA, ESA and Adler archives for the best planetary astronomy visuals the first movement, “Mars, the Bringer of War”, was started in December 2005. Additional movements were produced in the following months. During Far Out Friday of May 2006, “Jupiter, the Bringer of Jollity” was premiered in the Universe Theatre and nine days later, the entire video suite (a term coined to complement the musical genre orchestral suite) titled *Gustav Holst's The Planets* was premiered at Dominican University in River Forest and at Symphony Center in Chicago. The concert program explained the artist's intent: “The synchronized videos are not intended to be seen as documentaries but as art pieces that aim to inspire audiences and encourage them to learn more about our solar system and the Universe.” Judging by the response of the audience of more than 2,000, they were inspired indeed.

The video suite was also well received by critics. “Trained as a scientist, Salgado revealed an acute musical sensitivity and keen eye for pacing and editing that matched Holst's music seamlessly,” said the Wednesday Journal of Oak Park and River Forest. This reception prompted the commission of a second work of this kind. *Astronomical Pictures at an Exhibition* was premiered on May 11 and 12, 2008. Synchronized with Mau-

rice Ravel's orchestrated version of Modest Mussorgsky's work, *Pictures at an Exhibition*, this video suite takes viewers through virtual galleries featuring art-like images and science visualizations of the cosmos as well as astronomy-inspired artwork. The Chicago Sun Times wrote, “The nature of the images alternated between ersatz video-game graphics and breathtakingly real satellite shots; who could have imagined that Mussorgsky's famous 1874 suite would be so ideally suited for both of them?”



Maestro Paul Freeman conducts the Chicago Sinfonietta during a rehearsal at the Chicago Symphony Center. Image credit: José Francisco Salgado

As part of the Adler's partnership with the Chicago Sinfonietta a pre- or post-concert lecture/Q&A session was held for each performance. This gave audience members the chance to directly interact with Dr. Salgado and was also an opportunity to provide more information about the science being presented. This kind of multidisciplinary outreach within and beyond the walls of the Adler is immensely satisfying and enables us to reach audiences that otherwise would not be exposed to the latest and most fundamental discoveries in astronomy.

Three years since its creation, *The Planets* is still serving as a world-wide ambassador for the Adler, having been presented in whole or part at a wide variety of venues nationally and worldwide. The interest in this work is unabated with nine showings scheduled so far over the next year (see the box on page 6). In a particularly exciting honor, *The Planets* will be presented during the opening ceremony of the International Year of Astronomy (IYA2009) at the UNESCO headquarters in Paris in January 2009.

In celebration of the IYA in 2009, the Adler is currently producing a new show to be presented in the Universe Theatre. This new show, based on *Astronomical Pictures at an Exhibition*, will be in 3D, allowing audiences to feel immersed in the virtual galleries. - José Francisco Salgado, PhD 🌟

A listing of concert performances may be found on page 8.

Department Report

continued from page 1

BROADENED AUDIENCE

On April 5 Far Horizons 12 had a picture perfect launch into clear skies. The primary purpose of the mission was to test the light sensor built by Illinois Math and Science Academy (IMSA) interns Chris Gropp and Robbie Zedric. The balloon flew to an altitude of 96,731 feet (18.32 miles) and traveled 85 miles before landing in a cornfield in Carlisle, Indiana. Tests after landing proved the success of the mission. Our balloon also had on board an intrepid adventurer - the world's first Astro-peep. As of this printing, the peep has been interviewed by the Chicago Tribune, mentioned on Fox News Chicago, Good Morning America and has had over 30,000 hits on Youtube. See a peep-eye view of the journey: go to www.youtube.com and search for 'astro peep'.

José Francisco Salgado was the featured speaker at *Latinos Unidos Con Vos* on April 12. Dr. Salgado spoke about the confluence of art and astronomy for an audience of about 200 people at the fund-raising event for college scholarships.

On April 18 Mark Hammergren spoke to the Adler Shepard Society about asteroids including historical sources and eye witness accounts. His presentation was enthusiastically received by the audience of 45.

Also in April Geza Gyuk and Mark SubbaRao spent a morning participating in the *Readers Are Leaders* program at West School in Glencoe. Drs. Gyuk and SubbaRao spoke about being astronomers and answered questions about astronomy. They spoke with 3 classrooms totalling about 60 students.

At the end of April, Drs. Gyuk, Hammergren and Steele traveled to Aurora, IL for the final presentations of this year's Space Science Research Interns from IMSA. Chris Gropp and Robbie Zedric presented the results of their work on light sensors and balloon flight mentored by Drs. Hammergren and Gyuk. Nate Simpson presented the results of his work with Dr. Steele analyzing VERITAS data.

On May 3 Phil Sakimoto (formerly of NASA) and the Supernova Club visited the Adler. After touring the museum and viewing a skyshow, they finished up their visit with a special Astronomy Conversations in the SVL hosted by Niklas Karlsson with SVL intern Joan Smith's assistance.

On May 11 at Dominican University and May 12 at Orchestra Hall, Dr. Salgado presented his most recent marriage of the visual arts and astronomy. This combined work of live music and video suite with the Chicago Sinfonietta featured Modest Mussorgsky's *Pictures at an Exhibition*, with Paul Freeman conducting. The performances were an overwhelming critical and popular success. The Adler staff was treated to a recorded version of the video suite in the Universe Theatre at a later date.

On May 28 Doug Roberts was the resident astronomer for

about 300 attendees at Member's Night. Dr. Roberts answered questions about and discussed the new sky show *Cosmic Collisions*, an immersive theatre experience that launches viewers on a trip through space and time to explore cosmic collisions.



Participants in the International Planetarium Society meeting, hosted by the Adler Planetarium in late June, enjoy a paper presentation.

Moving into the month of June, on June 4, Julieta Aguilera and Dr. Salgado were the keynote speakers at the Bilingual Earth and Science Project, *Teaching Parents to Support Their Children* Recognition Celebration of about 30 people. Ms. Aguilera delivered an address on promoting science literacy in the Latino community. Although Dr. Salgado was out of town, he thanked everyone for their participation via prerecorded video.

Our final Far Horizons launch of the quarter, Far Horizons 13, in preparation for this year's Astro-Science Workshop, was successfully accomplished on June 18. This balloon reached an altitude of 91,000 feet (17.24 miles) and traveled 59.7 miles to Pine Village, Indiana. Rhys Louis, a student summer intern participated in the launch, tracking and recovery.

MEDIA INTERACTIONS

In April Grace Wolf-Chase contributed an article to the newsletter *Lutheran Partners* titled *In The Middle of the Night*. Dr. Wolf-Chase's article was a brief explanation of Astronomy and star birth.

The Chicago Tribune quoted Dr. Roberts extensively in its May 13 article about Microsoft's free download-able World Wide Telescope (WWT). He explained in the article what the program does, its accessibility to amateur and professional astronomers alike and discussed the possibility of the WWT becoming a *Facebook* for astronomers. Many Adler staff including Drs. Fortson, Knappenberger, Roberts and SubbaRao are featured in Microsoft's online story about the WWT.

Also in May, Mike Smutko gave an interview with the Medill News Service about the Mars Phoenix Lander. Members of department answered other media questions regarding the

Phoenix Lander.

In June Dr. Gyuk again answered a selection of questions for *Kids Ink*, a syndicated column based on questions from school aged children.

GRANTS

In April Dr. Wolf-Chase and Ms. Karen Carney as co-PIs submitted a proposal to NASA, in conjunction with Northwestern University. If approved, their grant will fund the mentoring of undergraduate interns, the extension of offsite "Astronomy Conversations" and the development of museum-based classroom and kiosk software as well as related resource material. The title of the proposal is "Habitability of Extrasolar Planets and the Detection of Life".

In June Dr. Hammergren and Ms. Carney as co-PIs submitted a proposal to the National Science Foundation (NSF) to for a new grant to support our popular Astro-Science Workshop which serves talented sophomore and junior high school students with an interest in science.

OBSERVING

Drs. Wolf-Chase and Smutko continue their observing from Apache Point Observatory. Fortunately for them, their extensive observing program has all been conducted remotely: when their observations are over, they can just crawl into bed for the rest of the night!

April 1 - 13 Niklas Karlsson spent time with the VERITAS telescope array in Arizona observing gamma-ray sources.

Dr. Roberts was awarded four tracks of observing time with the Very Large Array radio telescope. This is in support of a multi-wavelength campaign to observe Sagittarius A*, the radio point source coincident with the supermassive black hole at the center of the Milky Way Galaxy. Other telescopes include HST, CARMA, ATCA and Chandra. Dr. Roberts was awarded 7 hours of observing time on each of the four days May 5,6,10 and 11.

CONFERENCES AND PRESENTATIONS

In April, Drs. Hammergren and Gyuk traveled to San Luis Obispo, CA to attend the 5th annual Cube Sat Developers' Workshop. Dr. Hammergren presented on the Adler's high altitude ballooning program and future satellite construction plans. Drs. Gyuk and Hammergren also toured the California Polytechnic State University's satellite construction labs for ideas to bring back to the Adler.

In April Lucy Fortson attended the Blazars 2008, Workshop on Blazar Variability across the Electromagnetic Spectrum in Palaiseau, France. She presented a poster on "The Whipple 10m Gamma-Ray Observatory."

In late May, Dr. Hammergren attended the International Space Development Conference 2008 in Washington, D.C. where he

presented a talk titled *NASA Student Collaborations and the International Community*.

At the beginning of June Drs. Fortson and Salgado attended the AAS/ASP conference in St. Louis. Dr. Fortson was on the program committee for the ASP conference and was one of the leaders for the session on *Citizen Science*. Dr. Salgado was one of the leaders of the workshop *Capturing Public Interest in Astronomy through Art and Music*.

June 25-27 Dr. Karlsson was in Los Angeles attending the first collaboration meeting for AGIS. AGIS is the next generation of Gamma-ray telescopes which will follow VERITAS. He discussed the Adler's EPO work for VERITAS as a stepping stone for similar work for AGIS.

In the last week of June, Drs. Karlsson and Steele were in Dublin at the VERITAS collaboration meeting. They gave presentations on the work the Adler has contributed to the calibration efforts and pointing monitor for the VERITAS telescope system.

The biennial meeting of the International Planetarium Society (IPS), hosted by Adler Planetarium, was held from June 27 - July 2 at the Hyatt Regency McCormick Place and the Adler Planetarium. Larry Ciupik led the core staff team consisting of Mark Webb, Julie Bishop, Beth Azuma, Michelle Nichols, and Karen Donnelly. The conference consisted of more than 100 lectures, papers, panels, workshops, posters, and demonstrations, and over 40 exhibits, as well as side trips to Fermilab, the Milwaukee Public Museum, and Yerkes Observatory.

Department members presenting papers at IPS included: Julieta Aguilera ("The SVL, A Working Laboratory Inside a Museum"), Dr. Salgado ("Broadening Audiences by Partnering with Symphony Orchestras"), Dr. Roberts ("Real-time Digital Dome Rendering using Modern Graphics Processing Units (GPUs)" and "Using New Lunar Reconnaissance Orbiter (LRO) Data in Planetaria") and Dr. SubbaRao ("Astronomical Data Standards for Planetarians").

SPACE SCIENCE RESEARCH INTERNS

Our Space Science Research Interns (SSRI) over the 2007-2008 school year from IMSA were Chris Gropp, Nate Simpson and Robbie Zedric.

Ms. Katherine Flynn joined the SSRI program in June 2008. Katie has a bachelor's degree in Chemistry and is interested in applying her degree to astronomy. She is working with Drs. Fortson, SubbaRao and Steele to study how chemical signatures seen in the spectra of Active Galactic Nuclei change over time and what this can tell us about the central black hole at the center of the active galaxy.

We also welcomed Arman Butt and Max Grady. Arman is a student at University of Illinois at Chicago and Max is a student

continued on page 6

Department Report

continued from page 5

at Loyola University. Both Arman and Max worked with Drs. Gyuk and Hammergren in the Far Horizons balloon program.

Additionally, the SVL hosted 3 interns this summer, Andy Perrotte, Joan Smith and Ben Steinhorn. Joan and Ben helped with the Lunar Reconnaissance Orbit Camera (LROC) Education and Public Outreach project as well as the Moon Wall, for the upcoming "Mission Moon" gallery, and the GeoWall. Joan and Ben both graduated high school this spring and are headed off to Massachusetts Institute of Technology. Andy will be continuing his studies in high school. We wish them good luck in their studies.

VISITORS

On May 9 the department welcomed Massimo Marengo who a seminar on "The Spitzer View of the epsilon Eridani Planetary System". Dr. Marengo is an astrophysicist at the Harvard-Smithsonian Center for Astrophysics and is a member of the team that was responsible for building and calibrating the Spitzer Space Telescope Infrared Array.

AWARDS AND SERVICE

Dr. Michael Smutko was elected to the Associated Student Government Faculty Honor Roll for 2007 - 2008 by the students Northwestern University. This is the second year that he has received this award.

Dr. Fortson attended the NASA Advisory Council at Stennis Space Center, AL.

PUBLICATIONS

"Additional Ultracool White Dwarfs Found in the Sloan Digital Sky Survey". H. Harris et al. (including G. Gyuk and M. SubbaRao); *ApJ* 679, 697 (2008)

"Average Properties of a Large Sample of $z_{\text{abs}} \sim z_{\text{em}}$ Associated Mg II Absorption Line Systems", (The SDSS collaboration -- including M. SubbaRao); *ApJ* 679, 239 (2008).

"VERITAS Observations of the γ -Ray Binary LS I +61 303", (the VERITAS Collaboration -- including L. Ciupik, L. Fortson and D. Steele), *ApJ* 679, 1427 (2008).

"The Observation of Gamma-Ray Emission from the Galaxy M87 above 250 GeV with VERITAS", 77 co-authors including L. Ciupik, L. Fortson, G. Gyuk and D. Steele: *ApJ* 679, 397 (2008).

Other publications are in preparation. 🌟

Images of Astronomy

THE SNOWFLAKE CLUSTER

This spectacular image is a composite of observations at different wavelengths, obtained with the Spitzer Space Telescope. Unlike the Hubble Space Telescope, Spitzer's instruments study thermal infrared emission from objects in space, not visible light. Because of this, Spitzer can study very cold objects that are only a few tens of degrees above absolute zero, and reveal stars that are currently forming in cold, dusty clouds, which are otherwise invisible. In this false color image, blue corresponds to light at the shortest infrared wavelengths, and red to light at the longest infrared wavelengths. Many of the older stars appear blue in this image, while the very youngest protostars (stars in the process of forming as gravity pulls together a cloud of gas and dust) appear red. The pink and red specks toward the center of this nebula, which resemble the spokes of a wheel or pattern of a snowflake, are infant stars a "mere" 100,000 years old. These stars appear to have formed in regularly spaced intervals, but over the course of their lives, their individual motions will disrupt the snowflake design.



Image Credit: NASA/JPL-Caltech/P.S. Teixeira (Center for Astrophysics)

Adler Astronomer Dr. Grace Wolf-Chase first identified the cold dusty cores associated with what has now been dubbed the "Snowflake Cluster" in her 1992 doctoral dissertation, using microwave observations from the 12-meter National Radio Astronomy Observatory (now the Arizona Radio Observatory) located on Kitt Peak, near Tucson, Arizona. These observations, together with her subsequent microwave observations obtained at the 15-meter James Clerk Maxwell Telescope on Mauna Kea in Hawaii, reveal the "cocoon" of dust in which the protostars of the Snowflake Cluster are embedded. One of these cocoons contains at least 10 Snowflake Cluster protostars, packed so closely that 40,000 such infant stars could fill the volume between our Sun and the next nearest star, Proxima Centauri! - Grace Wolf-Chase, PhD 🌟

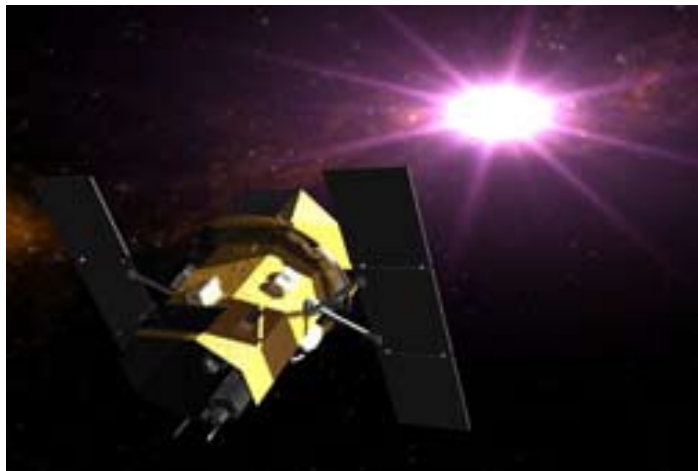
Astronomy News

SUPERNOVA CAUGHT IN THE ACT

On January 9th of this year, Princeton University (New Jersey) researchers, Dr. Alicia Soderberg and Dr. Edo Berger had the Swift X-ray Telescope trained on just the right galaxy and at just the right time to catch a star in the act of exploding.

The Swift satellite was launched to study rapidly changing gamma-ray and x-ray events, most notably gamma-ray bursts. A gamma-ray burst, likely produced during the “hypernova” death of a massive star, is incredibly bright, very fast and still somewhat mysterious.

Swift is equipped with three major instruments, the Burst Alert Telescope (BAT), the X-Ray Telescope (XRT) and the Ultraviolet/Optical Telescope (UVOT), which each play an important role.



This artist's rendition shows NASA's Swift satellite, which gives astronomers a powerful new tool to study the mysterious gamma-ray bursts. With its three complementary instruments and ability to change its pointing rapidly Swift is revolutionizing the field of “transient” x-ray astronomy. Image credit: NASA/Goddard Space Flight Center.

The first instrument onboard Swift to detect a Gamma-Ray Burst (GRB) is the Burst Alert Telescope (BAT). Within 10 seconds the Burst Alert Telescope localizes the burst and transmits the location to the observers on earth. The GRB position obtained from the BAT is also relayed to the pointing controls for the Swift satellite, which turns so that the burst is in the X-Ray Telescope (XRT) and Ultraviolet/Optical Telescope's (UVOT) fields of view. Over the next few minutes while collecting data, the XRT and UVOT further localize the burst and measure the brightness and spectrum of the object. All of this is done automatically without ground control.

As a result of Swift's rapid action, its array of telescopes, in partnership with the follow-up from ground-based telescopes enabled by its alerts, provide the most complete picture to date of gamma-ray bursts and their afterglow.

While studying Supernova 2007uy in the galaxy NGC 2770, which had appeared a few weeks prior, in December 2007, Drs.

Soderberg and Berger spotted an extraordinarily bright 5-minute X-ray blast on the opposite end of the galaxy. The Swift satellite, designed for just such rapid response, was quickly repositioned to point its other instruments on the blast.

In this case, when the BAT notified the observers on earth, Dr. Soderberg rounded up the international telescope community to start observing the event. Major telescopes including the Keck I (Hawaii), the Hubble Space Telescope, the Chandra X-Ray Observatory and the Apache Point Observatory in New Mexico were involved. The X-Ray burst lasted for 5 minutes. Only after the supernova appeared in the visible spectrum after a few days did the researchers fully understand how unique their observations were. This supernova was given the designation Supernova 2008d. Dr. Soderberg and colleagues published their findings in the May 22 issue of Nature.



On January 9 Swift caught a bright X-ray burst from a supernovae at the very moment of the explosion. This was the earliest ever detection of a supernova. A few days later, SN2008d appeared in visible light. SN2008d is in the circle on the upper right. The host galaxy NGC 2770, has been nicknamed the “Supernovae Factory”. Three supernovae have been observed within it in the past ten years! Image credit: NASA/Swift Science Team/Stefan Immler.

Typically, a supernova will occur when a star has consumed all of its fuel and collapses under its own weight. The resultant extremely dense star, now called a neutron star, compresses until it can no longer be squeezed. The “bounce” after this point of maximum compression triggers a shock wave, which causes the star to explode. The X-ray emission produced when this shock wave reaches the surface of the star is what the Swift Telescope picked up.

Prior to this January's event most of the data the scientific community had about supernovae came from observations of the visible light. Not only are these observations but a tiny

continued on page 8

Astronomy News

continued from page 7

section of the electromagnetic spectrum, they typically start many days after the explosion itself. The capture of Supernova 2008d as it happened gave scientists an opportunity to acquire vast amounts of information about the very beginning of the supernova process. - Rivka R.S. Rosen 🌟

Interview

continued from page 2

During those long stretches between the exciting results, I enjoy having the opportunity to engage with our museum visitors through programs like Astronomy Conversations in our new Space Visualization Lab. The excitement and awe we share together reminds me why I started out along this career path, and can definitely help cheer me up and find the ability to persevere when I'm stuck with a problem in my research.

PF: And the least?

DS: Not having a window and the feeling that a bus may one day fall through my ceiling. 🌟

The following is a list of cities in which Dr. Salgado's visual suites have been, or are scheduled to be, performed:

River Forest/Chicago, with full orchestra	May 2006
Melbourne, Australia	July 2006
Jet Propulsion Lab, Pasadena, CA	October 2006
Athens, Greece	October 2007
California Symphony, Walnut Creek, with full orchestra (The Planets)	October 2007
Chicago (Pritzker Pavilion), with full orchestra	August 2008
Bratislava, Slovakia (tentative)	October 2008
Pacific Symphony, Orange County, CA, with full orchestra	December 2008
Paris, France	January 2009
Madrid, Spain, with full orchestra (tentative)	February 2009
Ann Arbor, MI	February 2009
Delaware, OH, with full orchestra	March 2009
California Symphony, Walnut Creek, with full orchestra (Pictures at an Exhibition)	May 2009
Valencia, Spain, with full orchestra	July 2009

About the Adler Astronomy Department

The Adler Planetarium & Astronomy Museum has taken the lead among planetaria world-wide in establishing an astronomy and astrophysics research group in a museum setting. Adler Planetarium astronomers possess rich and diverse expertise in many areas of astronomy as well as other closely related science fields such as particle physics and geophysics. Several members of the Adler Astronomy Department also hold joint appointments at the University of Chicago and Northwestern University. The nature of these joint appointments strengthens the integration of the Adler and its educational mission with the research community.

You can download this newsletter and our Annual Report published in the Bulletin of the American Astronomical Society from: <http://www.adlerplanetarium.org/astronomy/>



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Astronomy Department
1300 S Lake Shore Drive
Chicago, IL 60605

Editor-in-Chief Geza Gyuk, PhD

Designer José Francisco Salgado, PhD

Contributing Writers Grace Wolf-Chase, PhD
Rivka R. S. Rosen, BS
José Francisco Salgado, PhD

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