



Department Report

INTRODUCTION

This spring marked the second anniversary of the Astronomy Conversations program. Over the past two years and almost 600 sessions we have welcomed over 30,000 visitors into the Space Visualization Lab for informal conversations about astronomy, research and what it is like to study astronomy as an astronomer or a historian. We are very proud of this program and look forward to continuing to expand it in the future.

The Department has also been very busy collaborating with other departments at the Adler on exhibits and programs such as the new Through the Looking Glass exhibit and the forty-fourth annual Astro-Science Workshop. Research endeavors have not been neglected, resulting in nine journal papers ranging in topics from supermassive black holes to massive star formation.

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The Crab Nebula (M1), appears about 6,000 light years away in the direction of Taurus, the Bull. This rapidly expanding cloud formed when a giant star exploded and eventually was seen by Chinese astronomers in 1054 AD. Imaged from the Doane Observatory by Larry Ciupik.

Interview

NIKLAS KARLSSON, POST DOCTORAL FELLOW



Dr. Karlsson has been with the Adler for a little over a year now. He received his PhD in Physics from the Royal Institute of Technology (KTH) in Stockholm. He

comes to us from Stanford University in California where he did research work for his PhD. He works at the Adler as part of the VERITAS collaboration group studying gamma rays of cosmic origin to learn about various celestial objects and phenomena.

PF: What led to your interest in astronomy?

NK: The PhD in astronomy just sort of happened. I have always had an interest for astronomy and science. In school I first liked chemistry better but in high school I discovered physics and its connection to math. As an undergraduate at KTH [the Royal Institute of Technology] I was set on studying computer science, but a good friend persuaded me to go for experimental physics. While looking for a fun project for a master's thesis, another friend told me about his master's work on the GLAST calorimeter. Through Professor Carlson at KTH, I had the opportunity to visit Stanford for six months, which prompted me to actually start thinking about astronomy/astrophysics as a career. After about 1-½ years of employment, there were layoffs at my company – the perfect time for graduate school. I contacted Professor Carlson, and got hooked up again with Professor Kamae at Stanford to do the research for my PhD thesis.

PF: What is your specific area of research?

NK: I am involved in the study of cosmic gamma rays. Using the VERITAS telescopes at the Whipple Observatory we look at many different objects. My favorite objects are normal galaxies, like our own Milky Way. We know that the Milky Way radiates gamma rays and it's fairly well understood that these are produced by cosmic rays hitting atoms in the interstellar gas. But we do not fully understand where the cosmic rays come from and how they get their incred-

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Interview: Niklas Karlsson, Post Doctoral Research Fellow

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ible energies. If other galaxies are not too different from our own then we expect them to also radiate gamma rays. By studying them in gamma rays I am hoping to develop further understanding of the origin of cosmic rays.

PF: What does a typical day of research look like?

NK: The first thing I do every morning is to go through email and in particular those related to VERITAS operations. I read the observer's log for the night and take notes on any data that is of interest to me. If there are new data on a source I am studying I start downloading that data to our computers. Once downloaded, the data is analyzed (semi-automatically) and this usually takes a couple of hours. In the meantime I follow up on other email or logs. As I am the lead developer of the VERITAS analysis software suite I have to keep up with bug reports, etc. and I spend a fair amount of my time programming. In the afternoon I have to inspect the data analysis results, produce plots and such. Usually I spend some time discussing the day's work with other members of the Adler VERITAS group.

PF: The VERITAS team goes to the Whipple Observatory on "shifts". What exactly is a shift?

NK: There are two types of shifts, Observation shifts and Calibration shifts. Observation shifts are normally two weeks long during which we take data for sources from a predetermined list. On a typical night the telescopes are started up at sunset and at astronomical twilight observations start. We work through the night and at sunrise the systems are shut down.

In the Calibration shifts we actively work to keep the telescopes and optical systems in peak working condition. This includes tasks such as aligning mirrors, measuring the optical point spread function (how well the telescopes focus light) and making sure the telescopes point in the right direction. Calibration is usually more fun as you are up and about and not just sitting in front of a computer monitor all night.

PF: What do you see yourself doing long term?

NK: At this point I see myself following the standard academic career path. After my posting here, a few more years as a research assistant (postdoc), then applying for a tenure track position at an as yet to be determined university (I do like the San Francisco Bay area). An alternative is to look for research scientist positions. But wherever I end up, I know I want to stay in astrophysics.

PF: You bring in a lot of delicious treats for teatime. Who taught you to cook and bake so well?

NK: Cooking and baking is really fun and I find it to be relaxing. My first experience comes quite naturally from my parents. I grew up with home cooked meals and my mom baked a lot. Many things I bake come from my mom's recipes but some also come from the Internet or cookbooks. When it comes to cooking, it is all about experimenting and trying things out. I get my inspiration from things like cooking shows on TV and books. The latest treat that I brought in was Lace Cookies. They were a big hit and people have been asking for the recipe. The recipe is below.



Dr. Karlsson aligns one of the over one thousand mirrors of the VERITAS telescope array using a laser alignment tool, a cherry picker and a wrench. Image Credit: Larry Ciupik.

PF: What is your favorite part about being in Chicago and working at the Adler?

NK: My favorite thing about Chicago is the Big City feeling. Everything, including work, is close by and there are so many things to see and experience. At the Adler I appreciate the friendly atmosphere.

PF: Your least favorite part(s)?

NK: I dislike all the potholes in roads here. Not having a window and natural light in the office is a bit of a drag, but the work environment is over all good.

Lace Cookies

Pre-heat oven to 400 degrees

1/2 cup sugar

1/2 cup flour

1/2 cup oatmeal

7/8 stick of butter

1/2 teaspoon baking powder

2 tablespoons molasses

Melt the butter over medium heat. Turn off heat and add the other ingredients. Mix well. Form into small balls. Place on a cookie sheet about 3 inches apart.

Bake 5-6 minutes until golden brown. 🌞

Project Notes

THE DOANE OBSERVATORY

Adler's Doane Observatory houses one of the largest telescopes regularly accessible to the public in the entire Chicago area (the other being at Northwestern University's Dearborn Observatory), and it is a premier component of the Adler's sky watching events.

The Doane Observatory was built in 1977 with generous assistance from the estate of the late Ralph C. Doane. Its unique architectural design won it immediate recognition from the American Institute of Architects. The original telescope, a 16" reflector, was replaced in 1987 by a new 0.5-meter Cassegrain built by DFM Engineering. This current telescope and mount are research grade and are extremely sturdy, being in good repair after more than two decades.

The Doane is a classical Cassegrain reflector. This means that it uses curved mirrors to collect and magnify light. Variations of the Cassegrain design are used in nearly every professional observatory today.

The Doane is mounted on a fork-style equatorial mounting that continually moves the 500-pound telescope and keeps it precisely tracking celestial objects. The tracking system relies on a clock drive that turns the telescope at the same rate as the earth rotates. This keeps celestial objects centered in the field of view. In fact, if special limit-switches didn't prevent it, the telescope would rotate itself in a full circle once every 24 hours.

The 20-inch diameter optics on the observatory's main telescope allow it to gather roughly 5000 times more light than the unaided human eye can. This huge light-gathering power gives the Adler's visitors stunning views of the heavens, despite the Doane's urban location on the lakefront of Chicago.



Doane Director Dr. Michael Smutko, prepares the observatory for an evening of observing. Image credit: Craig Stillwell

The Observatory also has two telescopes for daytime solar viewing. The first uses "white light" filters to let visitors safely

view features on the surface of the sun such as sunspots. The second is an "H-alpha" solar telescope (so-named because it allows only the first line of hydrogen's spectrum to pass through the telescope). The H-alpha telescope gives views of the sun's outer layers and phenomena such as loops and prominences that are associated with solar flares and active regions. By comparing the views in the Doane's two solar telescopes, visitors can get an excellent live view of the sun's activity.

Our telescope can be equipped with sensitive CCD cameras, video cameras, and other devices such as spectrographs. We can even run the telescope remotely over the internet. But we find that the most rewarding way for our visitors to experience the heavens is by looking through the telescope in person, with their own eyes.

In addition to daytime solar observing, and being open for special events such as comet appearances and eclipses, the Doane is open for evening public viewings at every Far Out Friday. Each year, thousands of people take part in Far Out Friday activities and they consistently describe visiting the Observatory as one of the highlights of their evenings.



Saturn through one of the Doane's smaller telescopes. Image credit: Larry Ciupik

From now through early summer, Saturn will be prominent in the evening sky and will be featured in the Doane during Far Out Friday events. Even more viewing events are in the planning stages for 2009's International Year of Astronomy, so check the Adler's web pages regularly for more information on upcoming sky watching events

Although the Doane is already a key part of the Adler's observing experiences, we are always looking for opportunities to make the experience better. One possibility under consideration is to develop the un-utilized spaces directly below the main telescope floor and the observing deck. The addition of a control room, a classroom/multi-use room, restrooms and HVAC in these areas would dramatically expand our ability to offer unique and inspiring programs in the Doane. - Michael Smutko, PhD 🌟

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FROM THE EARTH TO THE UNIVERSE

"From The Earth to the Universe", an exhibit of 54 images of the Universe with 2 explanatory panels has been installed at O'Hare Airport. The exhibit will be open from May 11 through Dec. 31. Ms. Julieta Aguilera, Mr. Julian Jackson and Dr. Mark SubbaRao collaborated on the exhibit. Mr. Randy Andersen and Mr. Bill Wilhelm will install banners with images from the exhibit on the light poles in the plaza in front of the museum.

BROADENED AUDIENCE

Adler Astronomers have been very busy with outreach activities. The following is only a small sample of their recent efforts:

Dr. Geza Gyuk spoke at the Lincoln Elementary Science Festival to an audience of 300 students and teachers about Black Holes and gravity.

Dr. Mark Hammergren spoke on "Asteroids, Alien Life and UFOs" at the AAAS 2009 "Family Science Days".

Dr. Doug Roberts presented at Junior Science Cafes at Northwestern University and Arlington Heights Library.

Dr. Lucy Fortson hosted a class of 2nd graders from the University of Chicago Lab School in the Space Visualization Lab (SVL). The students were fascinated with the lab and learned quite a bit about black holes and the collisions of galaxies and the life cycle of stars.

Dr. Grace Wolf-Chase gave an Astrobiology talk at Temple Israel in Gary, Indiana in mid-February. Invited to the presentation were members of local Lutheran, Methodist and Catholic churches. The presentation is part of "The Clergy Letter Project" celebrating science on or around Darwin's birthday every year.

Drs. SubbaRao and Gyuk gave a very successful multi-media presentation to The Citadel Group at their downtown Chicago corporate office. The auditorium seating 120 was full and the presentation was webcast as well as streamed live throughout the building. Their presentation, "A Guided Tour of the Universe", was about telescopes and the Universe. This was followed one month later by an equally successful presentation by Drs. Hammergren and Gyuk concerning asteroids.

Dr. José Francisco Salgado continues his series of performances of the Adler Video Suites. His stops have included Wheaton IL, Piastany Slovakia, Orange County CA, Paris France, Cuenca Spain and Delaware OH.

Mr. Larry Ciupik spoke with over 100 3rd - 7th graders at Decatur Elementary School in Chicago.

Dr. Roberts participated in the Readers are Leaders program at Glencoe South School. He talked with a first and second grade

class about space and how reading helps you prepare to be a scientist.

The Adler has expanded its very popular Astronomy Conversations in a trial off-site venue at the Chicago Temple downtown during the lunch hour. Dr. Wolf-Chase has spearheaded this effort with the help of Mr. Ciupik and Dr. Hammergren. So far there have been programs on October 23 & 30 and November 6. We hope to expand this effort as well as attract new audiences to the Adler.

MEDIA INTERACTIONS

Astronomy department members have had many interviews with media personalities over the past quarter. Many focused on Comet Lulin and the Adler Video Suites.

On March 30, Dr. Mike Smutko gave an interview to the Daily Northwestern about NASA astronaut and Northwestern alumnus Dr. Michael Barratt.

On March 6, Dr. Smutko's tour of the Doane Observatory for Art Norman, given during the media preview of the *International Year of Astronomy* was aired on *Chicago Tonight* (WTTW 11).

Dr. Salgado was featured in the *March Cafe Magazine*, the *Latino Lifestyle Magazine*. The article featured Dr. Salgado's work on the Adler Video Suites.

On and around March 12, Drs. Hammergren and Smutko spoke with various media outlets about the persistent rumors that the world will end on December 21, 2012. The ancient Mayan calendar ends on that day, which have led to the speculations of the end of the world.

In January and February, Dr. Hammergren made many media appearances involving the pass around our sun of Comet Lulin. He was interviewed on the *John Williams Show* on WGN (720 AM) radio as well as quoted in publications such as *National Geographic.com*, *the Chicago Sun Times*, *the Chicago Tribune* and *the Southtown Star*.

In January Mike Leonard of the *Today Show* interviewed Dr. SubbaRao. He spoke about his work mapping the Universe with the Sloan Digital Sky Survey (SDSS). The interview aired February 16.

Dr. Salgado's Video Suites, *The Planets and Pictures at an Exhibition*, has received global press coverage. Performances have been given rave reviews in American as well as Canadian, Spanish and French newspapers.

On December 18 Dr. Hammergren and Ms. Michelle Nichols were guests on the *Milt Rosenberg Show* (WGN 720 AM). They spoke with him about the 40th anniversary of the Apollo 8 mission (the first manned mission to orbit the moon) and the past and future of the space program.

Dr. Hammergren was quoted in the December 7 *Chicago Tribune* in an article about the remake of the classic science fic-

tion movie, "The Day The Earth Stood Still".

In November, Dr. Wolf-Chase was interviewed by Lenard Lopate of New York Public Radio (WNYC, 93.9 FM) about the Sun and the IBEX mission.

On August 28, Dr. Smutko gave Jenny Song of Associated Press an interview about light pollution as well as a tour of the Dearborn Observatory.

On August 11, Dr. Hammergren was interviewed by Chicago Public Radio (WBEZ, 91.5 FM) about the annual Perseid meteor shower.

In August Dr. Hammergren did an interview with Drew Hayes of WBBM (780 AM) radio on the detection of water ice on Mars by the Phoenix Lander.

Dr. Smutko also was interviewed on the subject of the Phoenix Lander. Brendan Cosgrove at Northwestern University interviewed him for their radio show/podcast.

GRANTS

The department received two grants from Illinois Space Grant Consortium. One grant was for Asteroid Occultation Research (Dr. Hammergren) for \$10,000. The second grant is for the Near Space Summer Interns (Space Science Research Interns) for \$8,000.

In May Drs. Gyuk and Fortson received word that their NSF grant request "TeV Studies of Active Galactic Nuclei and Starburst Galaxies with the VERITAS Gamma-ray Observatory" had reviewed favorably. This \$411,000 three-year grant will continue our current VERITAS research studies.

In January Dr. Hammergren received a 3-year, \$97,000 grant from NASA that will allow the museum to develop a new exhibit titled "Touch the Solar System". This exhibit will allow visitors to touch meteorites from the moon, Mars, Vesta and Ceres as well as give them a multi-media explanation of what it is made of and where it came from. The first of four stand-alone exhibits is expected to be in place in December 2009.

Dr. Hammergren and Ms. Karen Carney received a new, \$337,000 3-year grant from the National Science Foundation (NSF) to support our popular Astro-Science Workshop (ASW). The ASW is a 3-week summer program that serves talented incoming high school juniors and seniors with an interest in science.

Dr. Smutko received a grant through Northwestern University to support an undergraduate student for the 2008-9 academic year. The student is assisting with data processing of the star formation data that Drs. Smutko and Wolf-Chase collected at Apache Point Observatory.

OBSERVING

In December Mr. Ciupik and Dr. Karlsson spent time at Mt. Hopkins at the VERITAS site for a calibration shift. Dr. David

Steele followed in January with an observing shift.

Drs. Smutko and Wolf-Chase were awarded a total of 12 half-nights of remote observing at the Apache Point Observatory telescope between July and November 2008 to continue their survey of massive star forming regions.

Dr. Wolf-Chase received 2 hours of Spitzer Space Telescope time in November for the program "L1340: How Do Intermediate-Mass Stars Impact Their Natal Environment?" Dr. Wolf-Chase and colleagues also received 16 hours observing time for this project on the 15-m James Clerk Maxwell telescope and 1 hour on the Subaru telescope, both on Mauna Kea, last fall.

In November Dr. Roberts received 8 hours of VLA time to observe methonal line emission from masers in the inner few degrees of the Galactic Center.

In support of a course for upper-level physics/astronomy majors and graduate astronomy students Dr. Smutko installed a new CCD camera system at the Dearborn Observatory at Northwestern University. This involved rewiring parts of the telescope and machining and matching new mounts. Conferences and Presentations

CONFERENCES AND PRESENTATIONS

In late April Ms. Rivka Rosen attended the NCURA (National Council of University Research Administrators) Region IV Spring Meeting in Minneapolis.

Drs. Gyuk and Hammergren attended the annual CubeSat Developers workshop in San Luis Obispo, CA. April 21 - 25 (A CubeSat is a 10cm cube satellite with a mass up to 1 kg).

On March 3, Dr. Wolf-Chase gave the Astrophysics Colloquium at Northwestern University. Dr. Wolf-Chase's talk focused on the early stages of protostellar evolution.

Dr. Hammergren attended the Tucson Gem Mineral and Fossil Show in February. While there Dr. Hammergren met with our collaborators at the Planetary Science Institute and researched specimens for our new Touch the Solar System exhibit.

In January, Mr. Ciupik, Drs. Gyuk, Fortson, Karlsson and Steele attended a VERITAS collaboration meeting in Tucson, AZ.

Also in January, Dr. SubbaRao hosted a 2 day conference at the Adler for the project team of Interactions In Understanding the Universe (I2U2).

SPACE SCIENCE RESEARCH INTERNS

This year's Space Science Research Interns, Matt McDermott and Kelly Wu, from the Illinois Math and Science Academy joined the department on Wednesdays from September 2008 through April 2009. They worked with Drs. Gyuk and Hammergren building a flight data recorder for the Adler Far Horizons project.

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VISITORS

In April Dr. Chris Lintott, Dr. Kirk Borne and Dr. John Wallin visited the Adler to work on the Zooniverse project. Drs. Lintott, Pamela Gay and Wallin visited for a week in December to work with Ms. Carney and Dr. Fortson on the Galaxy Zoo project.

In September, Dr. Miguel Angel Aragon Calvo visited to work with Dr. SubbaRao on visualization techniques in the Space Visualization Lab (SVL).

AWARDS AND SERVICE

In March Ms. Rosen was awarded the NCURA (National Council of University Research Administrators) Region IV Spring Travel Award.

Dr. Gyuk participated in LIGO (Laser Interferometer Gravitational Wave Observatory) Review Panels in January, February and April.

In March Dr. Gyuk served on a review panel for the Deep Underground Science and Engineering Laboratory (DUSEL) project. DUSEL, a \$500 million NSF/DOE funded laboratory, will be the premier lab for the investigation of low-background physics, geophysics and subterranean biology.

Dr. Smutko was appointed Associate Master of Shepard Residential College at Northwestern University. His duties include assisting the Master of Shepard in overseeing the residential and academic lives of 171 undergraduate students as well as managing the participation of 20 faculty fellows in a multi-thematic dormitory.

In October, February and April Dr. Fortson traveled to Kennedy Space Center in Florida and Washington, D.C. in her capacity as a member of the NASA Advisory Council (NAC). The NAC provides advice and counsel directly to the NASA administration at the highest level.

Dr. Smutko has also been appointed by Northwestern's Provost's Office to serve in the University Hearing and Appeals System as a faculty representative. This is the highest of Northwestern's disciplinary boards and is responsible for adjudicating student misconduct and has the final say in matters such as expulsion from the university.

Dr. Wolf-Chase continues to serve on 2 University of Chicago committees: The APO 3.5 meter Time Allocation Committee (TAC) and the Large Optical Telescope Committee. This committee is concerned with transitioning from affiliation with the APO 3.5 meter consortium to a partnership with the Magellan Observatory consortium. The Magellan Observatory consists of a pair of 6.5-meter telescopes located at the Las Campanas Observatory in Chile. It is expected that the University of Chi-

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Images of Astronomy

25143 ITOKAWA

Spacecraft have visited only a handful of asteroids to snap close-up detailed photos. Those images we have received have generally seemed to confirm the public perception of asteroids as huge rocks, or monoliths, flying through space. But astronomers have long known that most asteroids must have sustained tremendous battering by collisions. Enough so that it's likely that many have been broken apart entirely.


25143 Itokawa is an asteroid of great interest: its orbit crosses that of both the Earth and Mars. This makes it a PHA or Potentially Hazardous Asteroid that may some day hit the Earth.



Asteroid 25143 Itokawa is a rubble pile, composed of fragments of a disrupted object that are held together only by the weak forces of mutual gravity. Image credit: JAXA.

Itokawa was the destination for Japan's ambitious Hayabusa sample return mission, the first ever attempted from the surface of an asteroid. The images of Itokawa show an object radically different from any other asteroid visited. Three things stand out. First is the presence of an enormous number of boulders of all sizes littering and embedded in the surface. Second is a complete absence of impact craters. Finally, Itokawa appears to be a contact binary of two roughly round objects that have fallen together and stuck.

This appearance was not a complete surprise. Astronomers specifically picked Itokawa as a possible "rubble pile" formed by the complete disruption and gravitational reintegration of a previously coherent object. Itokawa has literally been pounded to pieces and pulled back together by its own gravity.

The study of rubble piles like Itokawa is of great interest to the scientific community. Not only will they yield clues to the process by which asteroids and hence the Solar System were formed, but a knowledge of their composition and how they are held together will be essential if we ever have to deflect one headed towards the Earth. - Geza Gyuk, PhD 

Astronomy News

STARRY BUBBLES

A 180 ft long Spitzer Space Telescope portrait of the Milky Way, stitched together from 440,000 individual images, was revealed at the American Astronomical Society meeting in St. Louis, Missouri in June 2008. One of its most captivating features was the network of “bubbles” that thread through the plane of our Milky Way Galaxy. The infrared eyes of Spitzer can “see” the cold gas and dust that pervades our Galaxy, and stars of virtually every kind – young, old, massive, low mass – produce “winds” of particles that stream outward into this interstellar medium. Just as a snowplow sweeps up a dense ridge as it pushes through the snow, winds from stars in dense interstellar clouds sculpt their natal environments into ridges and bubbles of gas and dust.

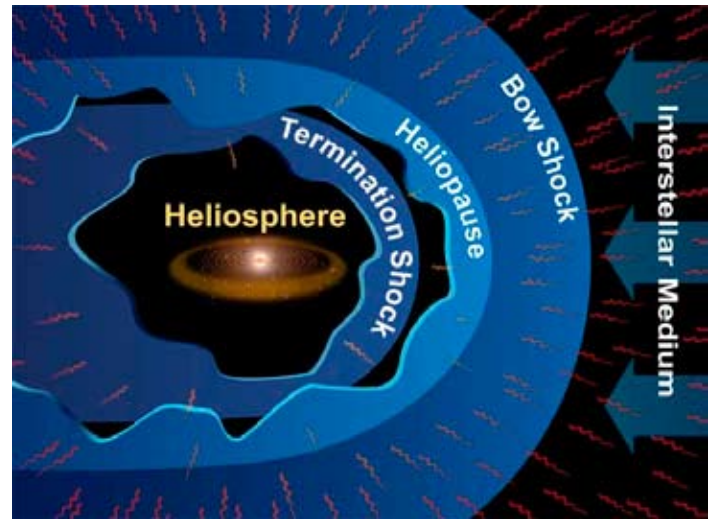


Star bubble GLM 33452+082 in the GLIMPSE I (Galactic Legacy Infrared MidPlane Survey Extraordinaire) survey. Image credit: Primary Investigator, E. Churchill.


Our Sun produces a wind, too, although our Sun’s wind pushes out into a much less dense environment. The solar wind is composed of charged particles that spiral out from the Sun along the Sun’s magnetic field at supersonic speeds (about 1 million miles per hour near the Sun’s surface). At the edge of the Solar System, these particles slow to subsonic speeds and mix with particles from the interstellar medium. “Seeing” the Sun’s bubble requires a special instrument.

Last October, NASA’s small explorer mission IBEX (Interstellar Boundary EXplorer) was launched from the Kwajalein Atoll in the Pacific Ocean to study the details of how the solar wind interacts with the interstellar medium. Launched into a highly eccentric Earth orbit that takes IBEX beyond the influence of Earth’s magnetic field, 5/6 of the way to the Moon at apogee

(its furthest distance from Earth), the IBEX sensors collect energetic neutral atoms (ENAs) that are produced when solar wind ions (mostly protons) pick up electrons from collisions with neutral interstellar atoms at the boundary of our Solar System. These ENAs travel in all directions, but the IBEX sensors collect a small fraction of the ENAs that travel back toward Earth.



The flow of solar wind abruptly slows at the termination shock, the innermost boundary of the solar system. The edge of the solar system is the heliopause. The bow shock pushes ahead through the interstellar medium as the heliosphere plows through the galaxy. Credit: Southwest Research Institute

IBEX will provide the first full-sky maps of ENAs coming from our Solar System’s boundary, enabling scientists to compare these observations to different models of how the solar wind interacts with the interstellar medium. In this way, scientists will be able to better understand the most important processes that shape the heliosphere. This is important because the Sun’s magnetic field deflects about 80% of the high-energy cosmic rays that would otherwise penetrate the Solar System unhindered. Two things are undoubtedly important to the balance between the heliosphere and interstellar medium: the strength of the solar wind, and the density of the interstellar medium. Although the Sun is currently traveling through an atypically sparse region of space known as the “Local Bubble”, this hasn’t always been the case, nor will it be in the future. The Sun orbits the center of our Galaxy with an orbital period of about 230 million years. As the Sun orbits, it also “bobs” in and out of the Galactic plane, crossing the plane about once every 33 million years. As the Sun’s journey has taken it through denser parts of the Galaxy, at times in the past, the heliosphere may actually have been smaller than the Earth’s orbit around the Sun. Although still highly speculative, it is possible that a greater influx of cosmic rays during such periods may have led to increased DNA mutations and periods of more rapid evolution of life on Earth. In any case, a better understanding of how our Sun’s bubble influences life on Earth, and conditions in the Solar System, will be critical to informing humanity’s expansion into the Solar System, and, eventually, beyond. - Grace Wolf-Chase, PhD 

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icago (and Adler) will have limited access to this facility within the next year.

In October, Dr. Smutko was elected to the Associated Student Government's Faculty Honor Roll, the highest honor that the students can directly give to faculty.

PUBLICATIONS

Astronomy department members have had a highly productive research cycle with a number of papers reaching publication. The following is a sampling of these papers.

"The June 2008 Flare of Markarian 421 from Optical to TeV Energies", (the VERITAS collaboration -- including L. Ciupik, L. Fortson, G. Gyuk, N. Karlsson and D. Steele), *ApJ* L 691, L13-L19 (2009).

"Veritas Observations of a Very High Energy Gamma-Ray Flare from the Blazar 3C66A", V. Acciari et al. (the VERITAS collaboration -- including L. Ciupik, L. Fortson, G. Gyuk, N. Karlsson and D. Steele), *ApJL* 693, 104 (2009)

"Discovery of Very High Energy Gamma-Ray Radiation from the BL Lac 1ES 0806+524", V. Acciari et al. (the VERITAS collaboration -- including L. Ciupik, L. Fortson, G. Gyuk, N. Karlsson and D. Steele), *ApJL* 690,126 (2009)

"VERITAS Observations of the BL Lac Object 1ES 1218+304", V. Acciari et al. (the VERITAS collaboration -- including L. Ciupik, L. Fortson, G. Gyuk, N. Karlsson and D. Steele), *ApJ* 695, 1370 (2009)

"Multiwavelength Observations of Markarian 421 in 2005-2006", D. Horan et al. (the VERITAS collaboration -- including L. Ciupik, L. Fortson, G. Gyuk, N. Karlsson and D. Steele), *ApJ* 695, 596 (2009)

"Massive Star Formation in the Molecular Ring Orbiting the Black Hole at the Galactic Center, F. Yusef-Zadeh, J. Braatz, M. Wardle, and D. Roberts, *ApJL* 683, 147 (2008)

"Simultaneous Chandra, CSO, and VLA Observations of SGR A*: The Nature of the Flaring Activity, F. Yusef-Zadeh et al. (including D. Roberts), *ApJ* 682, 361 (2008)

"VERITAS Discovery of >200 GeV Gamma-Ray Emission from the Intermediate-Frequency-Peaked BL Lacertae Object W Comae". (the VERITAS collaboration -- including, L. Ciupik, L. Fortson, G. Gyuk, N. Karlsson and D. Steele), *ApJ* L 684 No. 2 L 73 – L77 (2008).

"First results from VERITAS", D. Hanna et al. (the VERITAS collaboration -- including L. Ciupik, L. Fortson, G. Gyuk, N. Karlsson and D. Steele), *NIMA* 588, 26 (2008)

Other publications are in preparation. 🌟

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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