



Department Report

INTRODUCTION

With the seventh edition of *Prime Focus*, the Astronomy Department closes out the old year. Looking back, 2007 was a very productive year in establishing ourselves in the research community. We participated in review panels, submitted and received major grants, peer-reviewed papers, strengthened our collaborations and further developed our three core research programs. Finally, we have begun the process for hiring two new post-doctoral fellows to extend our research capacities.

We have been similarly busy in our outreach and education capacities. Highlights include the very successful “Astronomy Conversations” held in the SVL, service on numerous exhibit and program teams and many dozens of media requests. Also important have been an increasing representation of the Adler on external advisory committees for NASA, NSF and the IAU. We look forward to 2008!



The edge-on galaxy NGC 891 in the constellation of Andromeda resides about 30 million light years away. Dark dust clouds divide the galaxy and identify this galaxy as a spiral, although recent studies suggest it might be a barred spiral. Imaged from the Doane Observatory by Larry Ciupik.

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Interview

MICHAEL SMUTKO, ADLER ASTRONOMER



Dr. Michael Smutko has been with the Adler Astronomy Department for almost five years. Dr. Smutko is currently researching the formation of massive stars in the Milky Way galaxy. Dr. Smutko also holds a teaching position at Northwestern University where he teaches, among other things, a very popular Modern Cosmology course.

PF: *What was your path to astronomy?*

MS: I majored in astronomy in college because it was the coolest thing that I could find to study. While in college, I had the opportunity to work in an X-ray telescope construction lab for a summer and to spend another summer working at the National Solar Observatory in New Mexico. I also learned how to operate many kinds of telescopes and helped to host many public observing sessions at the campus observatory. Then I came to the University of Chicago for my Ph.D. where I spent my days, nights and weekends working on instrumentation for telescopes. My thesis work was building “deformable” mirrors that are intentionally distorted hundreds of times a second to correct for the effects of atmospheric turbulence. The technique is called “adaptive optics”. Similar adaptive optics systems are now found on most of the world’s largest ground-based telescopes like the Geminis and the Kecks.

PF: *What lead you to teaching?*

MS: I came to get rich—someone once told me that there were nearly limitless numbers of university faculty jobs that paid really, really well. Tragically, like Humphrey Bogart who came to Casablanca for the waters, “I was misinformed.”

PF: *What are your typical days like?*

MS: I’m up at 5:00 a.m. to beat traffic—even then, I spend about 90 minutes commuting to work. Once I get to work, I spend the day teaching, prepping for teaching, or doing research. I also oversee the operations of the observatories at the Adler and at Northwestern. This includes training people to use the telescopes, fixing any problems that crop up, and coordinat-

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Interview: Michael Smutko, Adler Astronomer

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ing observing sessions for the public and for students at Northwestern. Together, these are two of the largest telescopes accessible to the public in the Midwest, so managing them keeps me busy. I usually leave work about 4 p.m. and spend 90 minutes getting home again. Academic quarters in which I am teaching at Northwestern, I often spend my evenings replying to student emails or discussion board postings. My record is over 800 postings for a single class.

PF: *What is the best part of being an astronomer?*

MS: Finding things that literally no other person has ever seen before. Making those discoveries is much harder than just pointing a telescope at the sky—it can take years of hard work and there is no guarantee that something new will be found. If you are lucky enough, some of these discoveries will be scientifically useful and lead to a greater understanding of nature. While in college, I was fortunate enough to observe an extremely rare series of outbursts in the corona of the sun that led to my first professional publication and that got me hooked on observational astronomy. The next best part would have to be working with an animated robot on the Cartoon Network. Every scientist should work with a cartoon robot at least once. And of course, writing autobiographical articles for newsletters is another fun part of the job.

PF: *What is the best part of teaching?*

MS: Having the opportunity to tell people how amazing the universe is. And then telling them how much more there still is to learn.

PF: *What courses do you teach?*

MS: It varies from year to year, but I usually teach a seminar class about the universe to incoming freshman or an advanced hands-on class for upperclassmen and graduate students where the students learn how to use telescopes and other instruments to gather and process data. My largest class has been a general-level science distribution course called Modern Cosmology. For some reason, it has become one of the most popular classes at Northwestern—by March 2008, I will have taught over 1000 cosmology students in only three years. I've earned several teaching awards for the class, including the Arts & Sciences Alumni Teaching award, which is given to only two faculty members each year at Northwestern.

PF: *Why do you think the course has done so well?*

MS: What's not to love? The Big Bang, the expanding universe, black holes, Einstein, higher dimensions, the formation of everything that we know, and the possible fate of all of it. All that I have to do is get out of the way and let the material teach itself. Plus, I play Led Zeppelin in class—for pedagogical reasons, of course.



Sodium laser beams create “artificial stars” high in Earth’s atmosphere. These artificial stars are used as reference beacons so that adaptive optics systems can remove the effects of atmospheric distortion from the images of real astronomical objects located near the artificial stars. Here a sodium laser emerges from the 3.5-m telescope at Apache Point, New Mexico. Photo credit: M. Smutko

PF: *What would you do if you weren't an astronomer?*

MS: Fight Nazis in Africa. Oh wait, that's Bogart again...

PF: *Can you give a “short course” on star formation and your current research?*

MS: Despite the fact that there are roughly 100 billion stars in the Milky Way alone, a surprising amount of detail is not known about how stars actually form. Part of the reason is that stars form in the centers of dense, dark, cold clouds of dust and gas and optical light can't penetrate into or out of these dark clouds. Fortunately, other wavelengths of light, like infrared and radio, can. People who study star formation use instruments that detect light at these non-visible wavelengths. For the last few years, Adler Astronomer Grace Wolf-Chase and I have been using an infrared instrument called NICFPS located on the 3.5 meter telescope at Apache Point, New Mexico to study regions where very massive stars are forming in our own galaxy.

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Project Notes

CI - TEAM

Imagine, if you would, a young woman in high school. Each night, like others in her class, she uses a professional telescope to image some of the most distant objects in the Universe. In the days she works with researchers to unlock the mysteries at the hearts of supermassive black holes. She and her peers are participating in a research program about quasars - strange astronomical objects shining with the strength of a billion suns. Fiction? or, perhaps, exceptionally talented students involved in a selective university program for gifted high school students?

No, this is the CI-TEAM Variable Quasar Research project, based right here at the Adler Planetarium, and the students are regular high school students from across the country. Their teachers have participated in a 3-day workshop on quasars and observational astronomy. With this modest training the teachers can engage all of their students, not just those labeled as “gifted”, in an authentic research project studying quasars, some of the most enigmatic objects in the Universe.

So what are quasars? Quasars are a class of galaxies that have unusually, even stupendously, bright cores. They are thought to be powered by a supermassive central black hole that pulls in material from the surrounding galaxy. As the material falls into the tremendous gravity of the black hole it is partly converted into energy. So much energy is released that the quasar shines bright enough to be seen half-way across the universe! The Sloan Digital Sky Survey (SDSS), based in Apache Point, New Mexico, is nearing completion of its goal to digitally image one million galaxies. The survey is sensitive enough to pick up all but the faintest galaxies out to a distance of many millions of light years. Because of their tremendous luminosity, quasars are the most distant objects that the SDSS can see. The survey stores information about each quasar it detects in a digital database that anyone can access. Astronomers, but also the general public, can query this database to investigate properties of these quasars (and the millions of other objects stored in the SDSS archives).

Astronomers at the Adler Planetarium are investigating whether quasars vary their light output over time; and if the light output varies, what causes that variation to occur? But the information in the SDSS is just one snapshot in time of any given quasar. While the SDSS provides the most complete database of quasars ever compiled, further observations by other telescopes need to be made in order to determine whether the light output of any particular quasar changes from night to night. This is where the students and teachers of CI-TEAM come in. Using telescopes around the world they make follow-up measurements to study quasar variability.

Most of the students in CI-TEAM don't live anywhere near a research-grade telescope. How do they participate in the project? The answer is simple: many telescopes can now be operated remotely through the Internet. They can even take requests and queue up these requests for later - fulfilling many observations from different students robotically overnight while the students are at home in bed. When the student returns to school, images of the requested quasar are available to the student for further analysis using online tools built by Adler and Northwestern University astronomer, Doug Roberts. This tool allows the student to measure the light output (photometry) of the quasar registered on the image. By repeating this process for multiple images requested on different nights, the student compiles the data into a lightcurve that represents brightness over time. The student then applies statistical methods to determine whether the lightcurve is consistent with a “flat” line or the degree to which the light deviates, or varies, over time.



CI-TEAM workshop participants in July 2007. Thirteen high school teachers learned about quasars and the CI-TEAM program at the Dearborn Observatory.

This unique project is a joint effort between the Adler Astronomy and Education departments and draws on strong partnerships with Northwestern University, Johns Hopkins University, University of California, Berkeley and the University of Chicago. The Variable Quasar Research project allows the Adler to prototype one of the essential goals of the Research Division

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BROADENED AUDIENCE

José Francisco Salgado has started work on production of a video suite to accompany two performances of Modest Musorgsky's *Pictures at an Exhibition* by the Chicago Sinfonietta. The performances will take place in May at Dominican University and at Symphony Center. This production follows his highly popular video suite to *Gustav Holst's The Planets*.

The newest CyberInfrastructure-TEAM teachers are implementing the project in their classrooms. This year's project enables students and teachers to search the Sloan Digital Sky Survey for variable quasars, request follow up observations from remote telescopes, analyze the data and plot their results in order to discuss them with their peers and science mentors.

In October, Grace Wolf-Chase hosted a visit to the Adler by students in a Science & Religion class at Carthage College. The students toured the museum and viewed a presentation in the SVL on extrasolar planets.

Mark Hammergren led Adler members in viewing and photographing the Northern Lights on the Adler's October tour to Iceland. During the daylight hours the members also toured Iceland's spectacular lava fields.

In October Dr. Salgado presented *Gustav Holst's The Planets* video suite with the California Symphony during two concerts in Walnut Creek, CA.

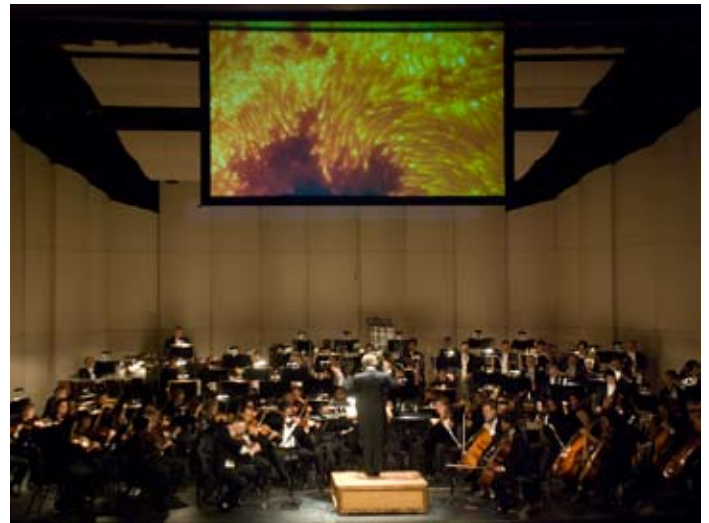
Also in October, Dr. Salgado also spoke with about 300 middle school students at the Melrose Park School about his work as an astronomer and science communicator. In November he served as a panelist in a career workshop organized by the University of Chicago's Career Advising & Planning Services.

There has been significant activity on the Interactions In Understanding the Universe (I2U2) project over the past several months. In October, the Adler received a motorized cosmic ray detector from Notre Dame University, replacing its older, manually operated one. In November, evaluation of the program's field trip experience was conducted with students from three area high schools. Revisions to the program based on this evaluation will undergo final testing in late Spring of 2008. Students participating in the field trip program can use the CyberSpace class room to access cosmic ray detectors across the country. The Adler's detector, which is currently in CyberSpace, will be featured in a planned exhibit component.

In November Doug Roberts spent the morning participating in the *Readers Are Leaders* program at Glencoe South grade school. Dr. Roberts read from some astronomy books from his childhood to a kindergarten class and a second grade class. The approximately 40 kids were very interested and had many questions, especially about Black Holes and the Solar System.

Included in the Adler's critically acclaimed *Mapping the Universe* exhibit, extended through March 1st, is a new visualization from the Sloan Digital Sky Survey by Mark SubbaRao and University of Chicago graduate student Dinoj Surendran. This visualization of the largest map of the Universe, using cutting edge technology, complements the historical artifacts in the exhibit.

Larry Ciupik's picture of Venus, the Moon, VERITAS telescope 3 and the International Space Station/Space Shuttle was published on the internet as NASA's *Astronomy Picture Of the Day* for November 8th. It may be viewed at: <http://antwrp.gsfc.nasa.gov/apod/ap071108.html>.



The California Symphony, conducted by Maestro Barry Jekowsky, performs *The Planets* during the second of two concerts in Walnut Creek, California. The performances were augmented by the video suite produced by José Francisco Salgado.

MEDIA INTERACTIONS

Astronomy Department members have had many interviews with television, radio and newspaper personalities during the past several months. Most of them focused Comet Holmes P/17, which was visible to the naked eye for a four week period during October and November of 2007. Geza Gyuk has also worked with Hope Babowice to write a number of articles on astronomy topics for the syndicated column *Kid's Ink*.

Dr. SubbaRao has contributed visualizations for several magazines including: *Astronomy* magazine (from the Sloan Digital Sky Survey), three for *Science* magazine (ultra high energy cosmic ray shower & SDSS). He has also contributed a program for the *Discovery Channel*.

OBSERVING

Dr. Wolf-Chase, together with colleagues from the Joint Astronomy Centre and the Spitzer Science Center were awarded several nights of observing at the James Clerk Maxwell Telescope on Mauna Kea this past October to investigate whether star formation in an isolated molecular cloud has been trig-

gered by the winds from intermediate-mass stars. Their proposal was one of the top ranked proposals for the October-November 2007 viewing period. Additionally, she and her colleagues were awarded several nights on the Canada France Hawaii Telescope and the University of Hawaii Telescope during this period, toward this project. Dr. Wolf-Chase was also awarded 7 half-nights for remote observing at Apache Point Observatory, NM investigating narrow-band near-infrared imaging of massive star forming regions.

Larry Ciupik, Lucy Fortson, Geza Gyuk and David Steele collectively spent the months of November and December at the VERITAS site in Arizona observing as well as working on the calibration measurements for the precision pointing monitor development of the telescopes.

CONFERENCES AND PRESENTATIONS

On September 5-7, the Adler co-hosted the Astronomical Society of the Pacific's EPO conference and 119th Annual Meeting. With Dr. Fortson and Lindsay Bartolone as the Adler co-chairs, the conference focused on building and supporting a vibrant and connected community of individuals and groups engaged in educational and public outreach in the disciplines of astronomy, astrobiology, space, and earth science. Mr. Ciupik was a panelist on a discussion entitled "Partnerships with Planetariums to Broaden the Audience and Communicate Advances in Astronomy", Dr. SubbaRao moderated a discussion entitled "The Astronomy Visualization Workshop Wrap-Up" and Drs. Fortson & SubbaRao were panelists on a discussion entitled "Using Collaborative Environments in Research-Based Science Education." Two preconference workshops were held at the Adler. Dr. Fortson organized a Remote Telescope Workshop, focused on building a cross-platform educational telescope network and Dr. SubbaRao organized a workshop devoted to Scientific Visualization.

In October Dr. Salgado attended the IAU meeting *Communicating Astronomy with the Public* in Athens, Greece where he presented two movements from *The Planets* video suite.

Dr. SubbaRao attended the Sloan Collaboration Meeting at Fermi Laboratories in Batavia, Illinois in November and the Cosmic Cartography Conference in Chicago in December.

Mr. Ciupik is heading the team organizing the International Planetarium Society 2008 conference to be held at the Adler in late June 2008.

STUDENTS & INTERNS

The department welcomed three interns from the Illinois Math and Science Academy (IMSA) for the 2007-08 school year. Nate Simpson is working with Dr. Steele on VERITAS and Chris Gropp and Robbie Zedric are helping Drs. Gyuk and Hammergren on the AdlerSpace ballooning project.

Jeremy Sepinsky, a graduate student at Northwestern University, is our new Public Education Outreach (Astro Science Workshop) Fellow.

ASTRO SCIENCE WORKSHOP

A missing and presumed lost near-space balloon launched during the Astro Science Workshop this past June was found this autumn and turned in to the Kankakee County Sheriff department. The balloon was retrieved by Dr. Hammergren and Rivka Rosen. Though the payload was somewhat damaged, all the data were retrieved and readable. The ASW students were overjoyed to receive copies of the video.

GRANTS

In the past quarter Dr. Wolf-Chase applied for two grants in support of the Adler's Star Formation research group. The first, in November, was a request to the NSF's astronomy and astrophysics research grants program for approximately \$172K. In December a second smaller request was sent to the Illinois Space Grant Consortium (ISGC) for a renewal of last year's successful award.

Drs. Gyuk and Hammergren also applied to the ISGC for a renewal of last year's grant. This grant will support two college summer interns as part of our Space Science Internship program. The interns will work with the AdlerSpace team to continue to develop our capacity to use high altitude balloons in educational outreach.

Drs. Hammergren (Principal Investigator) and Gyuk were awarded a new grant by the Mt. Cuba Astronomical Foundation. This \$10K grant will help them measure the size and shape of asteroids by studying the shadow of the asteroids as they cross the Earth's surface.

APPOINTMENTS & AWARDS

Dr. Wolf-Chase is currently serving on the University of Chicago's Apache Point Observatory 3.5-m telescope Time Allocation Committee and a committee to explore UC access to a large telescope (~10 m) within the next few years.

Dr. Fortson was recently appointed to serve on the International Year of Astronomy Working Group on Research Experiences for Students, Teachers and the Public. The IYA is occurring in 2009 to celebrate the 400th anniversary of the invention of the telescope and is planning activities across the globe to engage the public in astronomy. The Research Experiences working group is focusing on increasing science literacy by providing opportunities for students, teachers and the public to learn about the process of research in astronomy and participate in real astronomy research. Stay tuned for more information about how you can get involved!

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In November Dr. Gyuk served on the panel for the NSF final review of the Advanced LIGO project (Laser Interferometric Gravitational wave Observatory). This review panel also advised the NSF on the LIGO laboratory's next 5-year operations budget. LIGO, a \$400 million investment in the detection of gravitational waves, will open up an entirely new window on the universe.

In December Dr. Hammergren traveled to Annapolis to chair two NASA peer review panels for grant proposals. These advisory panels play a crucial role in guiding the direction of research done under NASA funding.

VISITORS

The Astronomy department welcomed Dr. John Wallin, associate professor of Space and Computational Science at George Mason University for a visit in mid-December. Dr. Wallin collaborated with Drs. Fortson, Gyuk and SubbaRao to develop a framework for modelling collisions between galaxies. Such galaxy collisions are thought to play a crucial role in shaping the evolution and growth of galaxies. This work formed the centerpiece of a Public Engagement in Research grant proposal submitted to NSF in early January.

PUBLICATIONS

During the last quarter members of the department were authors on three papers published in peer reviewed journals:

"The Whipple Observatory 10-m Gamma-ray Telescope, 1996-2007", (65 co-authors including L. Fortson); *Aph*, 28, 182 (2007).

"The Fifth Data Release of the Sloan Digital Sky Survey", (the SDSS collaboration -including M. SubbaRao); *ApJS*, 172, 634 (2007).

"The Variability of Polarized Radiation from Sgr A*", F. Yusef-Zadeh, M. Wardle, W. D. Cotton, C. O. Heinke, and D. A. Roberts; *ApJL*, 668, 47 (2007).

The award-winning student essays from the Pale Blue Dot III (PBD III) workshop were published in the August issue of *Astrobiology*, with an Introduction to PBDIII written by Program Organizing Committee Chair, Vikki Meadows and Local Organizing Committee Chair, Dr. Wolf-Chase. Meadows, V., & Wolf-Chase, G., 2007, "The Pale Blue Dot III Student Essay Contest", *Astrobiology*, 7(4), 705-706

Julieta Aguilera's Master's thesis (UIC, 2006) work is featured in the new book *From Models to Drawings*, chapter 15: 'Higher' Being and 'Higher' Drawing: Claude Bragdon's 'Fourth Dimension' and the Use of Computer Technology in Design, M. Frascari, J. Hale, B. Starkey, eds, Oct. 2007. Routledge.

Other papers are in progress. 🌟

Images of Astronomy

SPACE SHUTTLE ATLANTIS

In December Mark Hammergren was in Cape Canaveral, Florida for the much anticipated, but postponed launch of the Space Shuttle Atlantis mission STS-122. Mission Specialist Stan Love is a graduate school friend of Dr. Hammergren and issued him a personal invitation to attend the launch. This is Dr. Love's first spaceflight. He is married with two children and enjoys cycling, music and animation. He is expected to perform one spacewalk on this shuttle mission.

The launch was originally scheduled for December 6 but during the loading of the external fuel tank two of the four redundant liquid hydrogen Engine Cutoff (ECO) sensors failed to respond correctly. NASA safety regulations requiring at least 3 of the 4 ECO sensors to be operational, triggered postponement of the launch until December 9. During this second attempt, a single ECO sensor failed but more stringent safety requirements, based on a re-view of the previous launch attempt, required that all 4 sensors function to allow the countdown to proceed. The Atlantis had a beautiful launch on February 7, which Dr. Hammergren was in Florida to witness.



Space shuttle Atlantis, rising during liftoff Thursday February 7, 2008. Photo taken from the Banana Creek viewing area about 3 miles from the launch pad. Photo credit: M. Hammergren.

Space Shuttle Atlantis' 11-day mission delivered a key component to continue construction of the International Space Station (ISS). During the first of three spacewalks, a laboratory module, known as Columbus, was installed. The following day, astronauts entered the European Space Agency's module for the first time, expanding the research facilities of the station and providing crew members and scientists around the world with the ability to conduct a variety of life, physical and materials science experiments. The shuttle also delivered a new crewmember and brought astronaut Daniel Tani home after a nearly two-month mission at the ISS. – Mark Hammergren, PhD 🌟

Astronomy News

MARS IMPACT - ALMOST

In a twist that might seem ironic to fans of the disaster movies *Armageddon* and *Deep Impact*, astronomers were eagerly hoping that a newly discovered asteroid, 2007 WD5, would hit the planet Mars in late January. As it turns out, these hopes were dashed as further observations effectively eliminated the possibility of an impact. The asteroid was discovered on November 20, 2007 by Andrea Boattini of the University of Arizona's Catalina Sky Survey. The rapid motion of the asteroid in the sky at the time of discovery made it clear that it was an Earth-approaching asteroid and might pose an impact threat in the future. Such asteroids are the subject of intense scrutiny by astronomers: NASA has been charged by Congress with the task of discovering 90% of all potentially hazardous asteroids larger than one kilometer in diameter by the end of 2008. But it was not until astronomers at NASA's Near-Earth Object Program office at the Jet Propulsion Laboratory calculated the future trajectory of the asteroid did they note that it would make an extremely close pass by Mars on January 30. At that time, an impact with Mars could not be ruled out, with the probability of an impact being around 1 in 300.

To improve the accuracy of a calculated orbit, it is vital to extend the baseline in time over which positional measurements of an asteroid are made. The most straightforward way of doing this is to conduct follow-up observations using telescopes capable of seeing objects as faint as the asteroid. On December 18, 2007, astronomers at NASA's NEO Program sent a request for further observations to the Magdalena Ridge Observatory at the New Mexico Institute of Mining and Technology. That night, using a newly installed 2.4-meter telescope – considered



The impact of an asteroid the size of 2007 WD5 would produce a crater around one kilometer in diameter, somewhat larger than Victoria Crater on Mars, shown in this picture taken by the Mars Reconnaissance Orbiter. Victoria Crater is notable as being the current home of the Mars Exploration Rover Opportunity (visible on high resolution versions of this image).

a small telescope in the field of astronomy in general, but the largest routinely available for asteroid follow-up observations, Drs. Eileen and Bill Ryan successfully observed the asteroid. Instead of eliminating the possibility of an impact, however, the new measurements actually showed an impact was more likely, raising the chance of collision to 1 in 75. Aware of the potential for public interest in the subject, NASA then issued a press release announcing the possibility of the asteroid's impact with Mars.

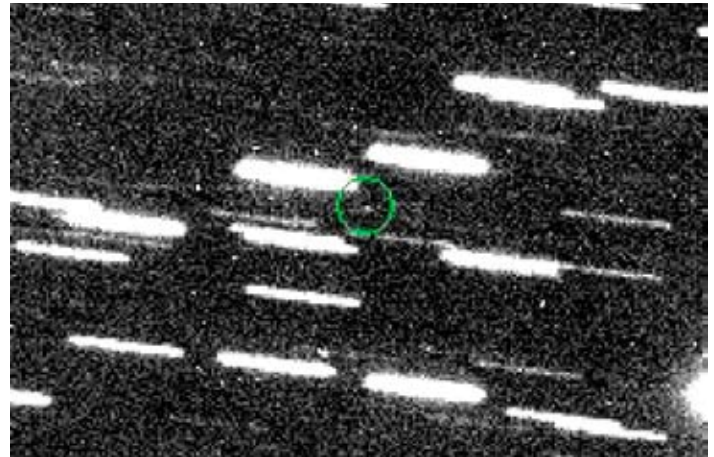


Image of 2007 WD5 from the University of Hawaii 2.2-meter telescope on Mauna Kea, Hawaii. The circled dot is the asteroid. Other dots are artifacts from cosmic rays. The stars are trailed because the telescope is tracking the asteroid as it moves among the stars. (Credit: Tholen, Bernardi, Micheli with support from the National Science Foundation).

One of the people who read the release was Dr. Andy Puckett, a recent University of Chicago graduate who coordinated the Adler's Astro-Science Workshop for several years, now a post-doc at the University of Alaska in Anchorage. He realized there was a possibility that the asteroid might have been in the right place at the right time for it to have been seen by the Sloan Digital Sky Survey. As it turns out, the asteroid was imaged (but not noticed) by the SDSS on November 8, 2007 – almost two weeks prior to its discovery at Catalina. Puckett's measurements extended the time arc by an additional twelve days, permitting a further refinement of the orbit. Once again, instead of decreasing the possibility of impact, the chances went up again – this time to about 1 in 25. Since then, a few additional observations of the asteroid have been made at the Magdalena Ridge Observatory. Further refinement of the asteroid's path, made in the waning days of December and the beginning of January gradually showed that the odds for impact have been reduced to 0.01%.

But what if it did hit? Based on the brightness of the asteroid, astronomers estimate that it is roughly 50 meters (about 160 feet) in diameter. The asteroid would approach Mars at a speed of about 13.5 kilometers per second (about 8.4 miles per second), pass relatively unscathed through Mars' thin atmosphere, and explode on the ground with an equivalent force of

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Interview

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PF: *How has new technology made your work easier?*

MS: The obvious answer is that my scientific observing sessions at Apache Point Observatory are now done over the Internet. I no longer have to sit in a cold, dark telescope dome for hours, nor do I even need to travel to the observatory in person. I can do most of my scientific observations from home using a Mac laptop and a cable modem. The best part is when I'm done observing for the night, I can crawl into my own bed just down the hallway. Now if technology could do something about those three-hour commutes, I'd be all set. ✨

Project News

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at the Adler Planetarium – to provide opportunities for non-traditional audiences to engage in authentic research experiences. This unique role of the Adler researchers – a direct connection to the public is what differentiates the Adler faculty from their counterpart at a University. By engaging high school students in research projects at the Adler through the use of the internet and other modern “cyber”-infrastructure, such as astronomical databases like the Sloan Digital Sky Survey, Adler astronomers and educators work to increase overall science literacy. – *Lucy Fortson* ✨

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about 3 megatons of TNT. It would produce a crater about one kilometer in diameter – too small to have any global or even regionally devastating effects, although it would likely loft a good deal of dust into the atmosphere.

Astronomers are quite keen to see such an impact (on another planet!). First, the fresh impact crater would be a natural excavation into Mars' geological past, exposing subsurface rocks at a variety of depths. Satellites currently in orbit around Mars would be able to study the new crater in detail, with a strong possibility that detailed “before” pictures of the impact site already exist. The event would also be of great interest to scientists who study hypervelocity impacts. Never before has an asteroid been seen to impact with a solid planet (in 1994, fragments of Comet Shoemaker-Levy 9 impacted Jupiter, a gas giant planet without a solid surface). Many laboratory studies of impacts have been done, but the largest craters produced in those works were less than 1/1000th as big as would be produced by 2007 WD5. – *Mark Hammergren* ✨

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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