



January 2012

## News from the High Plains



Two of our 2011 graduates: Anne- Marie (above) and Zohreh (below).



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Greetings Alumni & Friends,

Another year has flown by! In the past twelve months we have seen two new faculty join us. Assistant Professor Adam Myers is an expert on quasars and is involved in large astronomical surveys that he uses to constrain cosmological parameters. Assistant Professor Hannah Jang-Condell studies theoretical aspects of the formation of planets outside our Solar System, computationally intensive work that will benefit from the new Wyoming NCAR supercomputer that will come online this October. You can learn more about Hannah and Adam in this newsletter.

We have been experimenting with the “studio” format when teaching some of our introductory physics courses. Similar to what you may have experienced way back in high school science class, the Studio Physics format collapses lecture, lab, and discussion into one integrated whole. The goal is to continually and smoothly transition between theory, experiment, and small group work, instead of formally separating these aspects into different time blocks during the week, with typically different instructors leading each aspect. We are excited by our initial efforts to improve student learning with Studio Physics, and look forward to 2015 when we will move our introductory labs into a new \$50 million science lab teaching facility that will be named after U.S. Senator Michael Enzi who spearheaded the funding.

In other curricular news, we are developing a second hands-on advanced experimental lab course for our undergraduate majors. Following the recent addition of Modern Physics Lab to our repertoire, this new advanced lab course will focus on electronics and Labview-based applications.

As usual, this newsletter includes updates from selected alumni. Please email us at [physics@uwyo.edu](mailto:physics@uwyo.edu) if you would like to let us know about your career path. We also post these updates on our alumni page [physics.uwyo.edu/Alumni/alumni.html](http://physics.uwyo.edu/Alumni/alumni.html).

All the best,

Danny Dale  
Department Head





# DEPARTMENT NEWS

## NASA Flying Observer

Flying at 41,000 feet elevation aboard the world's largest airborne astronomical observatory, graduate student **Michael Lundquist** gazes into a region of the Universe that has never previously been observed in such detail. The data he collects will add valuable information in the scientific quest to determine how and why stars are formed.

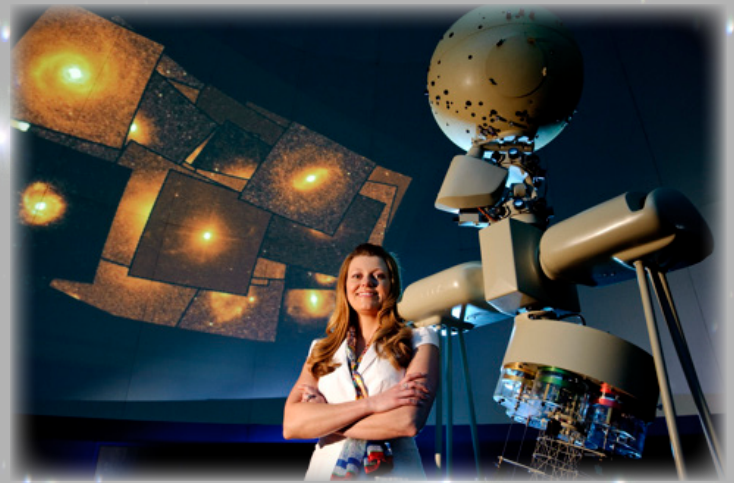
Lundquist was selected to conduct research aboard NASA's Stratospheric Observatory for Infrared Astronomy (SOFIA), a 20-ton telescope mounted in the rear fuselage of a Boeing 747SP aircraft. Lundquist was among the first scientists chosen to fly on SOFIA to record infrared images of dust and gases in a region where the star-formation process is in its early stages. The data will help scientists answer questions that cannot be answered by ground-based infrared telescopes.



"You can't do this type of infrared imaging from the ground, you have to be above the atmosphere in the cold, high elevations that cool the telescope. This environment reduces the thermal noise, so you can get crystal clear images that have never been seen before," says Lundquist, whose research is directed by Associate Professor **Chip Kobulnicky**.

"I'm looking at intermediate mass star-forming regions, those areas that form stars that are between low-mass stars such as our sun, and the much more massive stars that can be many times larger than the sun," he says. "SOFIA provides a new tool that fills a much-needed gap in the wavelengths we can examine to answer these questions."

Adapted from UW a press release



## PLANETARIUM NEWS

Each year in our planetarium we host upwards of 1000 visitors from UW, the local schools, and the general public. We use our venerable Spitz starball to project the nighttime sky onto the dome to teach stargazers about the motions of the heavens, as well as the history and science behind the distribution and appearance of celestial objects.

Lab Coordinator **Travis Laurance** directs the planetarium activities, including recruiting and training undergraduate students to help deliver the shows. An integral part of each show is the Q&A interaction with the audience. Shows frequently end with a laser light show synchronized to music along with a trip to the roof of the Physical Sciences Building where people can view constellations, nebulae, etc. through our 16-inch STAR observatory. STAR also comes equipped with an H $\alpha$  filter for daytime viewing of the Sun and its solar spots and flares. Our local chapter of the Society of Physics Students has also used the planetarium for monthly movie nights!

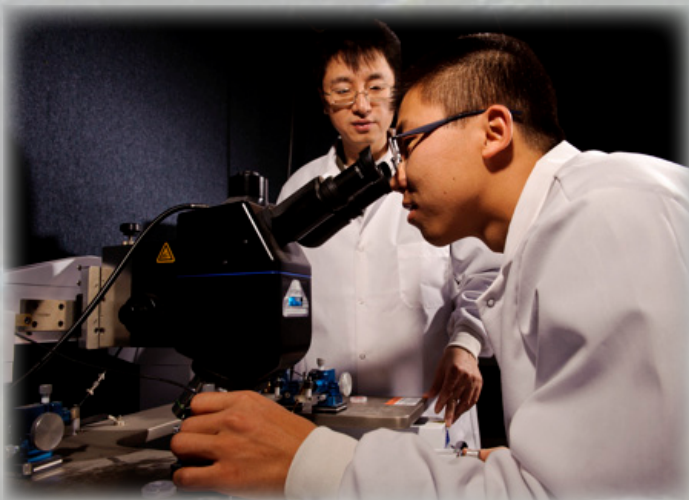




## FACULTY NEWS

The Department recently received \$3.2 million to conduct research on novel materials for solar energy conversion. The EPSCoR (Experimental Program to Stimulate Competitive Research) funding is in the form of two competitive grants, one from the U.S. Department of Energy for \$2.4 million and another from NASA for \$750,000. EPSCoR has brought millions of dollars into Wyoming to help UW faculty become competitive in obtaining federal research grants while also improving the state's science and engineering infrastructure and strengthening departmental and multidisciplinary research groups. The project brings together scientists from several departments to develop and test new, more affordable and more efficient nanostructure-based photovoltaic materials to convert sunlight into electricity.

This effort is led by Assistant Professor **Wenyong Wang**. Physics faculty **Jinke Tang** and **Yuri Dahnovsky** are also part of the team. Part of the funds is being used to create a world-class device characterization and fabrication laboratory for Dr. Wang's group. His lab now houses an electron beam evaporator, a reactive ion etcher, a chemical vapor deposition system, a mask aligner, among other key research instruments. This equipment is being used to synthesize different nanomaterials and to create micro- and nano-scale device structures. Other equipment includes an inelastic electron tunneling spectroscope for measuring localized vibrational features in tunnel junctions, which is critical for molecular transport studies.



**Adam Myers**

Adam earned his Ph.D. from Durham University. He was a postdoctoral fellow and research scientist at the University of Illinois and is a senior Alexander von Humboldt Fellow at Max-Planck, Heidelberg. Adam studies cosmology and galaxy evolution using quasars, extremely luminous objects powered by supermassive black holes at the center of galaxies, as probes of the structure of our cosmos on very large scales. After briefly training as a chef, Adam studied physics because he “didn’t want to work nights and weekends”. He is now an observational astronomer. Adam is excited to find out if there are other Geordies in Wyoming.



**Hannah  
Jam-Condell**

Hannah earned a bachelor's degree from M.I.T. and a Ph.D. from Harvard University. Before coming to UW, she worked as a postdoctoral fellow at the Carnegie Institution of Washington, the University of Maryland, and the Space Telescope Science Institute. She is an expert in theoretical studies of planet formation and computational astrophysics. She studies how the interactions between planets and the early environments in protoplanetary disks around young stars affect the planet formation process. In her free time, Hannah likes to knit elaborate garments and sometimes even spin her own yarn. She also enjoys participating in choral singing and community theater. Despite her Midwest origins, Hannah is excited about moving to the mountains, where she looks forward to hiking, camping, and perhaps even learning to ski properly.



## ALUMNI NEWS

**John Hefti** (B.S. 1979) has worked in all phases of geophysics during 30 years as a Geophysicist. After graduating from UW he began his career in Denver with an independent oil company as an interpreter and has held various positions in seismic acquisition, processing, interpretation, potential fields, and magnetics. He has worked throughout North America, South America, Africa, The Middle East, Asia, and The Arctic. He joined Exxon Exploration in 1997 as an Exploration Geophysicist and is currently based in Houston working primarily unconventional resource projects. His most recent project was an 80,000 channel multi-component project in Piceance, CO.

**David Ciardi** (Ph.D. 1997) is currently an Associate Research Scientist at the NASA Exoplanet Science Institute located at the California Institute of Technology in Pasadena, CA. After UW, David went to the University of Florida in 1998 as a postdoctoral scholar working with Elizabeth Lada on star formation utilizing the Wide-Field Infrared Explorer (WIRE). After WIRE malfunctioned upon entering Earth-orbit, David took his extensive infrared instrumentation experience obtained at UW and joined the infrared instrumentation group at UF where he designed the spectroscopic modes for the mid-infrared instruments T-ReCS (Gemini) and CanariCam (GTC). David left for the NASA Exoplanet Science Institute at Caltech in 2003; since arriving at Caltech, David has been involved in various exoplanet searches from both the ground and space and is currently a science team member of both the CoRoT and Kepler exoplanet missions.

**Brannon McCullough** (B.S. 2004) entered the Biological and Biomedical Science PhD program at Yale University in 2005 and in 2008 he received an MPhil. in Molecular Biophysics and Biochemistry. He has been investigating the mechanics of how actin filaments are severed by cofilin, a process that is central to cell motility. He is finishing his dissertation research and will defend early next year. Brannon will then start a postdoc at the University of Minnesota to investigate the mechanobiology of brain cancer cell motility and migration by testing computational models with quantitative microscopy experiments.

**Carey (Borghi) Friia** (B.S. 2004) is now a wife and mother in Denver, CO. She still gets her physics phreak on as a Mission Planning Engineer for Lockheed Martin Space Systems Company. Carey works in the Human Space Flight Advanced Program group and currently is working on Lockheed Martin's Athena space launch vehicle program. Carey is responsible for trajectory analysis and mission planning for a launch that will take place in early 2014.

Working at the front end of the program has its challenges in part due to the fact that even the smallest error at this phase of the program can create huge schedule impact later. Carey relies on the discipline she learned while studying physics at UW to make sure her work is 100% correct. Carey's work involves analyzing the launch vehicle trajectory to orbit for various satellite deployment conditions. She also supports a program to develop a new, non-nuclear intercontinental ballistic missile capable of persecuting targets at global ranges with conventional munitions delivered with extremely high accuracy. She recently authored a paper on the Prompt Global Strike capability for an intra-company symposium. "I never thought I'd be working on missile programs when I was learning kinematics and thermodynamics back in school", Carey says.

**Jacob Kutzer** (B.S. 2006) is currently a commissioned officer in the United States Navy. He was accepted into the Navy's Nuclear Propulsion Officer Candidate program in June of 2010 and graduated from Officer Candidate School in January of 2011. He finished Naval Nuclear Power School in October and is scheduled to go to Groton, CT to Submarine Officer Basic Course in January 2012. In March he will start training at the Nuclear Power Training Unit in Ballston Spa, NY to get hands-on experience running a nuclear reactor. When that is finished he will get orders to a submarine, as yet to be determined, for about three years.

**Mojtaba Jafarpour** (Ph.D. 1975) has been teaching in the Physics Department at Shahid Chamran University in Ahwaz, Iran, for the last 36 years.

**Anthony Zukaitis** (B.S. 1996) received a Ph.D. in computational physics from UNLV in 2001. He worked for Bechtel Nevada (Los Alamos Operations) for three years, and is currently working as a Technical Staff Member at Los Alamos National Lab.



# WIRO NEWS

Associate Professor **Chip Kobulnicky** and Assistant Professor **Adam Myers**, Department of Physics and Astronomy received a \$750,000 grant from NASA to upgrade the Wyoming Infrared Observatory (WIRO) with several key infrastructure elements. In addition to equipment upgrades, the grant will fund a large ultraviolet imaging survey, in part to help find distant quasars, luminous galaxies harboring supermassive black holes.

Among the improvements to the facility is the installation of a backup power generator that will enable the observatory to remain in operation and protect sensitive instruments in the event of a power failure. "This allows us to operate complex, state of the art detectors at WIRO, putting us in the position to compete for additional observing programs in support of NASA missions," said Kobulnicky. "We also will install a high-speed Internet link between campus and the observatory, allowing us to move large amounts of astronomical data that typify modern science programs at 20 megabytes per second or more. This high-speed connectivity also will let astronomers observe from remote locations, including campus or even places around the world."

Situated among the pines on Jelm Mountain (altitude 9,656 ft.), WIRO currently houses the largest infrared-optimized telescope operated by a single university. A premier location for infrared astronomical research, the facility has been an important instrument used by nearly 30 Ph.D. students over the last decade, as well as UW faculty and outside users. The observatory has periodically undergone upgrades to help it remain competitive with the ever-growing, ever-larger suite of world telescopes.

The most scientifically advantageous upgrade is to replace the 4 megapixel camera with a 16 megapixel camera and detector that will let astronomers view sky areas four times larger than before. "This may not sound large by today's digital camera standards," Kobulnicky said, "but astronomical cameras are very sensitive and have very low noise to let us see even a single photon of light making its way to us from across the visible universe – a light travel time of 12 billion years."

This new camera is sensitive to ultraviolet light, a relatively unviewed part of the electromagnetic spectrum, and may lead to new insights as to what the universe was doing in its early history. Myers, the leader of this part of the NASA-funded project, said, "Currently, there is much excitement in cosmology at the possibility of measuring a ripple-called

a 'baryon acoustic oscillation' - that was imprinted on the large-scale universe very early in its formation. This feature is a yardstick that allows distances in the universe to be measured very precisely. But it is only visible on very large scales-the sorts of scales that are mapped out by quasars."

Quasars are extremely bright galactic hearts powered by gas falling into the most massive black holes in the universe. Because quasars are so bright, they are visible out to distances much larger than for typical galaxies. Most quasars are particularly bright and blue. Historically, this allowed them to be found by looking for objects in the sky that are excessively bright in the ultraviolet light. "Currently, very few large imaging surveys in the ultraviolet are planned in the northern sky," Myers said. "This presents an opportunity for WIRO, which has enough observing time available, to conduct a large survey in ultraviolet light."

"This upgrade on the observatory will help UW astronomers be competitive for at least another decade," Kobulnicky said. "It lets us take advantage of Wyoming's dark skies to do science that is more difficult elsewhere."

Adapted from the A&S Report, with permission from Diana Marie Waggener, editor of A&S Report



Chip Kobulnicky, Mike Brotherton and Dave Cook with the new Polaris.



# SPS NEWS

Chapters from Northern Colorado in Greeley, Colorado School of Mines in Golden, and Mesa State in Grand Junction, and UW attended the SPS Zone Meeting on April 16th, 2011 in Laramie.

The meeting started off with a session of research talks. Gary White from AIP, Washington D.C., gave an engaging opening talk about the 'Physics of Spandex'. The analogy to four-dimensional space-time and the surprising difference between the forces in Spandex and in space-time got the student crowd actively involved right away.

Kevin Stenson from UC Boulder, who works at the Large Hadron Collider in Switzerland, introduced the students to contemporary particle physics and even took the time to address last spring's headlines on the discovery of a fifth force at Fermilab. It turns out that Kevin's skepticism seems to have been warranted...

Further activities included: a presentation by our own **Mike Brotherton** ('Science and Science Fiction') and the Colorado School of Mines chapter ('How to turn your students into active SPS officers'), a research poster session, physics graduate student **Brian Scoggins** reviewing the design and construction of a cryostat, a demo competition (see photo), and an SPS zone business meeting (with Skype participation by the

Denver Metropolitan chapter councilor).

Physics & Astronomy faculty gave ten minute descriptions of their research projects and related opportunities for graduate students, and this was followed by a tour through two new research labs where thin films and nano-wires (worms) are being produced, characterized, and analyzed.



**Rudi Michalak** would like to bring a crew of undergraduate students to the Quadrennial SPS Congress to be held in Florida this September. These meetings involve roundtable discussions, distinguished speakers, tours (e.g., Kennedy Space Center), and research presentations by the students. If you would like to contribute to our Student Support Fund, or to the department in general, please visit <https://secure.imodules.com/s/1254/giving.aspx?sid=1254&gid=1&pgid=340uwyo>.

Physics & Astronomy

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