



*Astrophysics & Space Science Theory Group • Early Universe Cosmology & Strings Group  
Gravity, Cosmology & Astroparticle Physics Group • Hypervelocity Impacts & Dusty Plasmas Lab  
Space Science Lab • Meyer Observatory*

## CASPER settles into new home at the Baylor Research & Innovation Collaborative

**New space at the state-of-the-art research and discovery park brings CASPER's research functions under one roof for the first time.**

In the spring of 2014, Baylor's Center for Astrophysics, Space Physics and Engineering Research (CASPER) began moving into the new Baylor Research and Innovation Collaborative (BRIC). The move brings CASPER faculty — along with their research and graduate students — under one roof for the first time in the center's history.

### Built for collaboration

Dr. Truell Hyde, Baylor's vice provost for research and the director of CASPER, said the center's new home at the BRIC will make it easier for CASPER faculty to collaborate with each other, and also encourage them to interact with other BRIC occupants, including other Baylor faculty, industry leaders and workforce development professionals.

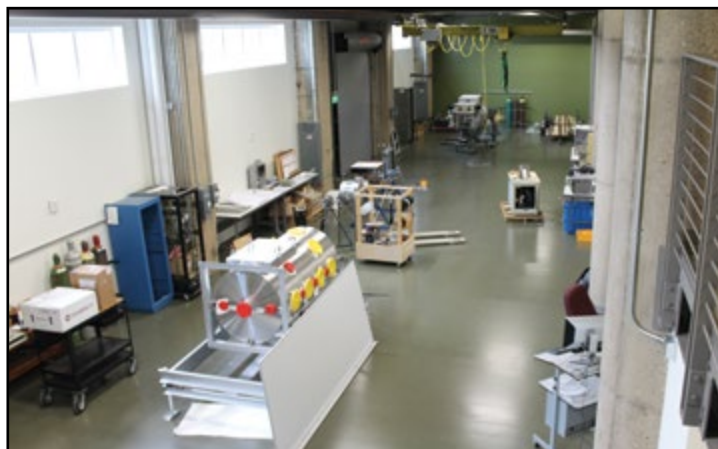
"Previously, we had faculty and equipment spread out between our lab at TSTC and various locations on Baylor's main campus," Hyde said. "Now, with all of CASPER at the BRIC, instead of driving to a different location to meet with colleagues, our faculty can simply walk down the hall."

### Faculty and students benefit

In addition to the benefits of bringing faculty members into closer proximity, CASPER's graduate and undergraduate students will also benefit from working in the collaborative environment within the BRIC.

Hyde said that exposure to a variety of research projects can help students make connections to their own projects and discover applications across other disciplines, and it can also help them find new career opportunities they might not otherwise have considered.

"The BRIC is intentionally designed to create opportunities for interaction between people who might never run into each other in a traditional campus setting. This gives our students the experience of seeing other types of high-level research first-hand."



*Above, the new CASPER lab in its new home at the BRIC. Below, the BRIC's exterior and entrance to the parking lot. The BRIC, housed in the former General Tire & Rubber Co. manufacturing plant, is the centerpiece of the planned Central Texas Technology and Research Park (CTTRP).*

# CASPER-designed Piezo Dust Detector set to fly as primary scientific payload on upcoming ARMADILLO satellite launch

## Data from the PDD should help future satellites avoid damage from orbital debris.

The Piezo Dust Detector (PDD), a piece of equipment built by a team of CASPER graduate and undergraduate students, is slated for launch in late 2014 on the Atmosphere Related Measurements And Detection of submILLimeter Objects (ARMADILLO) satellite, which was built by the Satellite Design Lab at the University of Texas at Austin.

### ARMADILLO project wins national award

Early this year, the ARMADILLO project was named the winner of the University Nanosatellite-7 (NS-7) competition sponsored by the U.S. Air Force. Ten university teams submitted their satellite projects for review by a panel of experts. ARMADILLO was named the winner in the CubeSat division, which includes satellites with mass less than 10 kg. The award carries with it two years of further development and a commitment of launch assistance from the U.S. Air Force.

The PDD will collect data on the extremely small (less than 1mm) pieces of dust and debris that satellites encounter while in orbit. CASPER graduate student Matthew Fellows says that the data that will be collected is important because even very small particles can cause significant damage to delicate satellite equipment.

“The dust particles are moving in space so fast that they can damage optics equipment and other sensors,” says Fellows, a second-year master’s student in Baylor’s College of Engineering and Computer Science. “Even a tiny particle can have the same impact energy as a .22 caliber rifle shot.”

Data from the PDD will also help CASPER researchers and their collaborators to develop methods for avoiding space debris and shielding future satellites from impact.

### Turning down the heat

Jimmy Schmoke, CASPER research assistant/technician, said that one important consideration in building the PDD is managing the heat load to ensure components aren’t damaged.

“In space, there’s no way for heat to escape, so we have to plan ahead and make sure the detector doesn’t have power sources located too closely together, where heat can build up,” said Schmoke. “We place the components in vacuum chambers to simulate the space environment and mimic the sun with heat sources so we can monitor how the detector will respond to heat coming from different angles.”

### Shooting for the stars

In addition to the important data the PDD will gather during its orbital mission, the project also has benefits here on the ground for the students who have worked on it as part of their senior capstone design course within the School of Engineering and Computer Science (ECS).

Since 2011 when the PDD project was initiated, it has become an ongoing part of the ECS senior capstone design course required of all engineering majors. Over this time, the experience gained by

participating students has helped a number of them acquire positions in industry or proceed to graduate school.

Much of this is due to the unique nature of the opportunity. Chase Wiley, a senior mechanical engineering major from Tyler, served as the PDD’s project manager during the fall 2013 semester. Wiley states that his team’s hard work allowed what is inherently a challenging technical process to run smoothly, producing an outcome of which they could all be proud.

“It’s a special experience in that the PDD is actually going to space,” Wiley says. “Not many students can say they worked on a satellite that actually went into orbit.”

### Support from local aviation group

Development of the PDD was supported in part by the Greater Waco Aviation Alliance, a committee of the Greater Waco Chamber dedicated to promoting the Waco area as a center of aviation excellence. Five students have worked on the project through support provided by the alliance.

Kris Collins, an Aviation Alliance staff member, said their support for CASPER is directly related to the alliance’s goal of promoting the Waco area as a center of aviation excellence.

“The alliance supports workforce development in our area, and Baylor is a tremendous partner. CASPER programs like this one help elevate the status of our entire community and attract talented individuals and companies to the region.”

### A tradition of space science research

Dr. Truell Hyde, the director of CASPER, says the PDD project is one of the latest in a long line of space science research projects.

“Space science research at CASPER is built on a proud tradition of developing and flying light instruments that dates back to the 1960s. Dr. Merle Alexander, the founder of Baylor’s original Space Science Lab, along with current and past personnel within CASPER were actively involved on NASA and ESA flight missions including Explorer I, Vanguard III, Explorer VI, Explorer VIII, the OGO series, the Atlas Able IV Lunar Satellites, Ranger I, Ranger II, Surveyor, Lunar Explorer 35, Pioneer V, Mariner II, Mariner IV, the Cometary Dust Environment Monitor (CODEM), the Dust Impact Detection System (DIDSY), the European Retrieval Carrier, the Particulate Matter Experiment and the Wakesfield Facility projects,” Hyde says.

“The opportunity to once again provide a flight instrument, particularly a dust detector developed and built at Baylor, reminds CASPER of the proud heritage the center inherited from Dr. Alexander’s research legacy.”

## GROUP UPDATES

### Astrophysics & Space Science Theory Group / Space Science Lab / Hypervelocity Impacts & Dusty Plasma Lab (ASSTG/SSL/HIDPL)

#### 44th Lunar and Planetary Science Conference March 18-22, 2013, The Woodlands, Texas

CASPER members Lorin Matthews, Truell Hyde, Michael Dropmann, and REU fellows Will Barnes and Sarah Frazier attended the 44th Lunar and Planetary Science Conference held in The Woodlands, Texas, March 18-22.

The group presented a total of four posters, including:

*Lunar Environment Simulation Capabilities at CASPER*, authors M. Dropmann, R. Laufer, G. Herdrich, T. W. Hyde, M. Cook, and J. Schmoke.

*Charging Behavior of Dust Aggregates in a Cosmic Plasma Environment*, authors S. A. Frazier, L. S. Matthews, and T. W. Hyde.

*Dust Grain Growth in a Protoplanetary Disk: Effects of Location on Charge and Size*, authors W. Barnes, L. S. Matthews and T. W. Hyde.

*Effect of Stochastic Charging on Cosmic Dust Aggregation*, authors L. S. Matthews, B. Shotorban, and T. W. Hyde.

#### 54th Annual Meeting of the APS Division of Plasma Physics Oct. 29-Nov. 2, 2012, Providence, RI

Members of CASPER traveled to Providence, RI, to attend the 54th Annual Meeting of the APS Division of Plasma Physics. Although Hurricane Sandy threatened to put a damper on the event, the rainfall and wind in downtown Providence proved to be remarkably light.

Truell Hyde, Lorin Matthews, Jorge Carmona, Jie Kong, Ke Qiao, Michael Dropmann, Brandon Harris, and Mudi Chen were joined by former CASPER member Angela Douglass, now at Ouachita Baptist University, and REU student Allen Davis, who participated via FaceTime due to inclement weather.

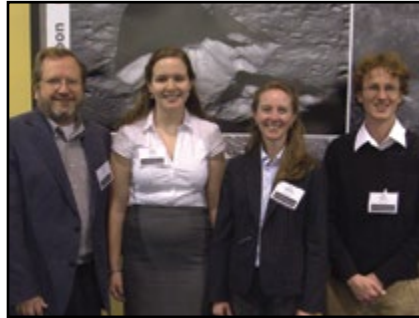
The group presented three posters and six papers, including:

*Dynamics of Dust Aggregates in a Complex Plasma*, authors A. Davis, J. Carmona-Reyes, L. S. Matthews and T. W. Hyde.

*Experimental Determination of Horizontal Confinement Within a Glass Box in a GEC RF Reference Cell*, authors A. Douglass, R. Moore, L. S. Matthews and T. W. Hyde.

*The 2012 CASPER Physics Circus*, authors J. Carmona-Reyes, A. Land-Zandstra, J. Cheng, A. Douglass, B. Harris, Z. Zhang, M. Chen, L. S. Matthews and T. W. Hyde.

*Collective Phenomena in Extended Particle Chains within a Complex Plasma*, authors T. W. Hyde, J. Kong, M. Chen, K. Qiao, B. Harris, A. Douglass, J. Carmona-Reyes and L. S. Matthews.



### Astrophysics & Space Science Theory Group / Space Science Lab / Hypervelocity Impacts & Dusty Plasma Lab (ASSTG/SSL/HIDPL) Group Members

#### Faculty and Staff

Truell Hyde	René Laufer
Lorin Matthews	Jorge Carmona-Reyes
Trey Cade	Michael Cook
Jie Kong	Jimmy Schmoke
Ray Nazzario	William Anderson
Ke Qiao	Jonatan Lenells

#### Adjunct Faculty

Phillip Anz-Meador	Ralf Srama
John Fitch	Marlene Rosenberg
Peter Hartmann	Sean Casey
Georg Herdrich	David Lary
Rainer Sandau	

#### Graduate Students

Mudi Chen	Raziyeh Yousefi
Brandon Harris	Bo Zhang

#### Visiting Graduate Students

Michael Dropmann	Nikolai Sterionow
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#### Interns

Thomas Abernathy	David Ferrell
Ian Anderson	Jeff Lam
Jesse Cadenhead	Tyrell McSpadden
Kyle Carter	Nicole Sohns

### Early Universe Cosmology and Strings Research Group (EUCOS) Members

#### Faculty and Staff

Gerald Cleaver	Qin (Tim) Sheng
Klaus Kirsten	

#### Graduate Students

Jared Greenwald	Yanbin Deng
Douglas Moore	Brandon Mattingly

#### Undergraduate Student

Ziyi Tang



## GROUP UPDATES, CONT.

*Mode coupling and resonance instabilities in a horizontal finite dust chain*, authors K. Qiao, J. Kong, Z. Zhang, L. S. Matthews and T. W. Hyde.

*Probe Induced Dust Cavities in Complex Plasma*, authors B. Harris, L. S. Matthews and T. W. Hyde.

*Particle Hopping within an Extended Vertical Chain in a Complex Plasma*, authors M. Chen, J. Kong, K. Qiao, J. Carmona-Reyes, B. Harris, L. S. Matthews and T. W. Hyde.

*Using Falling Dust Particles as In-Situ Probes to Measure the Vertical Electric Force Distribution in a Complex Plasma*, authors J. Kong, K. Qiao, J. Carmona-Reyes, A. Douglass, Z. Zhang, L. S. Matthews and T. W. Hyde.

*Initial Operation of the Miniaturized Inductively Heated Plasma Generator IPG6*, authors M. Dropmann, G. Herdrich, R. Laufer, H. Koch, C. Gomringer, M. Cook, J. Schmoke, L. S. Matthews and T. W. Hyde.

## Early Universe Cosmology and Strings Research Group (EUCOS)

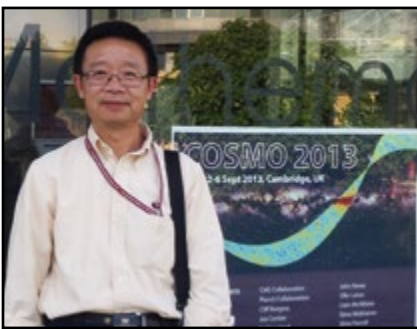
### CASPER faculty member named to editorial positions



Dr. Jerry Cleaver, the head of CASPER's Early Universe Cosmology and Strings Research group (EUCOS), has been named to editorial positions at three physics journals.

Cleaver has become a member of the International Advisory Board of the *Journal of the British Interplanetary Society*. He was also appointed guest editor of the journal *Advances in Mathematical Physics* for a special edition on "Advances in String/M/F-Theory," and of the journal *Galaxies* for a special edition on "Particle Physics and Quantum Gravity Implications for Cosmology."

### CASPER member delivers keynote at major international symposium



Dr. Tim Sheng presented a keynote lecture on computational mathematics at the 12th International Symposium on Distributed Computing and Applications to Business, Engineering and Science (DCABES) held Sept. 2-6, 2013 in London, England.

Sheng gave a presentation entitled *Modern ADI, LOD and adaptive decomposition algorithms for highly effective and efficient computations*, in which he discussed the latest high performance computing strategies in sequential and parallel computations in multi-physics applications, as well as multiple scale distributions and splitting structures.

In addition to his presentation at DCABES, Sheng also attended the New Mathematical Directions for Quantum Information conference at the Isaac Newton Institute for Mathematical Sciences and the International Conference on Particle Physics and Cosmology (COSMO 2013) at the Stephen Hawking Centre for Theoretical Cosmology in Cambridge.

## Gravity, Cosmology & Astroparticle Physics Group (GCAP) Members

### Faculty and Adjunct Faculty

Anzhong Wang	N.O. Santos
Jonatan Lenells	Yumei Wu
Qin (Tim) Sheng	Yungui Gong
Rong-Gen Gai	Klaus Kirsten

### Graduate Students

Bao-Fei Li	Xinwen Wang
Pedro Morales	Tiffany Jones
V.H. Satheeshkumar	Josh Padgett
Bahram Shakerin	Chong Sun

### Undergraduate Student

Jeremy Smallwood

## Experimental Astronomy Group Members

### Faculty

Dwight Russell	Dick Campbell
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## From the big stage to the small screen

### CASPER creates educational video game that captures all the fun and excitement of the Physics Circus show.

For years, the Physics Circus has brought schoolchildren from across Central Texas to the Baylor campus for a hands-on learning experience. This year, instead of bringing students to the Physics Circus, CASPER is bringing the Physics Circus to the students with a new educational video game based on the long-running show.

Jorge Carmona-Reyes, CASPER's assistant director of educational research and outreach, says the goal of the Physics Circus has always been to broaden outreach efforts while giving teachers an additional tool for presenting science curriculum. The video game format provides a new way to reach students who might not have access to a live performance.

"We wanted computers and the World Wide Web to be the new venue for the Physics Circus. Presenting the material as a video game gives us a wider presence because we're not limited to schools in Central Texas. We can offer the game to any school in the country."

The game's plot is based on the 2010 Physics Circus theme, 'CSI: CASPER Science Investigators.' Just like in the live production, where students gathered data in the 'Physics Fun House' to help them solve a mysterious crime, students playing the game put their science knowledge to use in a series of challenges based on age-appropriate curriculum.

"Each clue is related to a specific topic," says Carmona-Reyes, "so teachers can present the game alongside their instruction to reinforce the lessons. The teachers can also see their students' scores and monitor their progress as they move through the lessons." Along with the Physics Circus game, teachers also receive access to a special website with curriculum notes, presentation ideas and videos from the actual Physics Circus performances.

Carmona-Reyes says the curriculum, developed by CASPER faculty and graduate students, is scalable and meant to provide a challenging experience for students at many grade levels.

"There will be different levels of complexity in the game," he explains, "so students can learn basic concepts in middle school and early high school, then relate those ideas to higher-level concepts later. The fact that we're delivering the material online also means teachers have access to the latest lessons as soon as they're released — they don't have to wait until next year's Physics Circus performance."

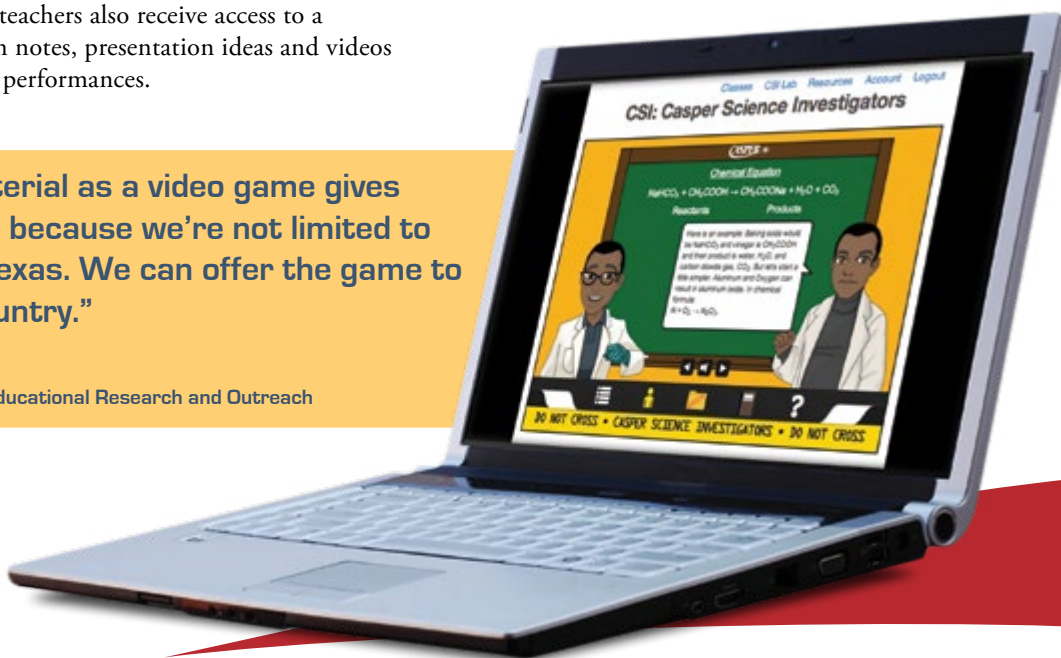
Putting all this content into a game that holds the attention of the average student required an interdisciplinary approach. This is being accomplished using students in the web design and technology programs at Texas State Technical College Waco, who are working alongside CASPER to help bring the concept to life.

The TSTC students' expertise is helping drive innovations in new versions of the game. Carmona-Reyes says future plans include translating the game into Spanish and other languages, as well as developing mobile versions of the game that students can play on their tablet computer or smartphone.

"We want to continue bringing curriculum to teachers and students in new ways," he says. "With help from our partners, we can provide more concepts and more interactivity to reach students."

**"Presenting the material as a video game gives us a wider presence because we're not limited to schools in Central Texas. We can offer the game to any school in the country."**

**Jorge Carmona-Reyes**  
CASPER Assistant Director of Educational Research and Outreach



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## NEW CASPER FACULTY



### **Dr. Sean Casey**

**CASPER Adjunct Associate Professor**

**Senior Scientist, Universities Space Research Association (USRA)**

**Co-Founder and Managing Director, Silicon Valley Space Center**

Dr. Casey is a Senior Scientist with USRA's SOFIA program and has served as the management and technical lead for SOFIA's science instrument development program. He has a Ph.D. in astrophysics from the University of Chicago and dual MBAs from the Berkeley Haas and Columbia Schools of Business.



### **Dr. Jonatan Lenells**

**Assistant Professor**

**Baylor Department of Mathematics**

Dr. Lenells received his Ph.D. in Mathematics at Lund University in Sweden in 2006. He served as a visiting assistant professor at the University of California, Santa Barbara and as a Marie Curie Research Fellow at the University of Cambridge, UK. His research focuses on nonlinear partial differential equations (PDEs) and their applications to problems in mathematical physics.



### **Dr. Dwight Russell**

**Associate Professor**

**Baylor Department of Physics**

Dr. Russell received his bachelor's degree summa cum laude from the Western Kentucky University. He received his master's and doctoral degrees from Vanderbilt University. His research focus is materials science, seeking to understand the quantum-mechanical properties of solids, including their surface properties, defects and the effects of radiation.



### **Dr. Jie Yang**

**CASPER Visiting Professor**

**Lanzhou University**

**Lanzhou, China**

Dr. Jie Yang received his bachelor's degree, master's degree and Ph.D. from Lanzhou University in China. His research interests include theoretical particle physics, gravitational physics, cosmology and special and general relativity.



### **Dr. Tao Zhu**

**CASPER Assistant Research Professor**

Dr. Tao Zhu received his Ph.D degree in 2010 in theoretical physics from Lanzhou University in China. He then joined Zhejiang University of Technology as an assistant professor, where he worked until January of 2013. His research interests include quantum gravity, thermal radiation from black holes, and brane-world cosmology. His current focus is on Horava-Lifshitz gravity and quantum effects in the early universe.



## **More seminars and other news available on the CASPER website**

Visit our website at <http://www.baylor.edu/casper> and click "News/Media" to learn more about recent events, upcoming seminars and new discoveries by CASPER faculty and their partners.



### Dr. Joseph Kuehl

Geochemical and Environmental Research Group, Texas A&M University

*Advances in Hypersonic Boundary Layer Stability*

**Abstract:**

The laminar-turbulent transition process is of fundamental importance to sub-, super- and hypersonic aerodynamics. It may critically drive system drag, thermal loading, propulsive efficiency and vehicle stability. The National Center for Hypersonic Laminar-Turbulent Transition Research takes a systems approach combining experimental, numerical and theoretical research to better understand the transition process; beginning with free stream disturbance receptivity, through linear and nonlinear growth of disturbances, up to turbulent breakdown. Kuehl's presentation focused on recent developments in our understanding of the linear and nonlinear evolution of disturbance modes in hypersonic boundary layers (primarily the so called second mode and crossflow instabilities which are dominant above Mach 4). In particular, the newly developed JoKHeR code was introduced. JoKHeR is a nonlinear parabolized stability equations (NPSE) code which accounts for nonparallel and nonlinear effect over generic topography. The NPSE method provides an efficient alternative to direct numerical simulation by applying a marching procedure to track the modal evolution of boundary layer disturbances.



### Andrew Roberts

Northrup Grumman Corp. (Ret.), NASA HQ (Ret.)

*NASA's Airborne Science Program*

**Abstract:**

Roberts discussed his involvement in NASA's Airborne Science Program and the program's support of the National Science Objectives. He explained how aircraft have been utilized for the development of new systems and education. He also discussed ways universities can participate in the research activity NASA sponsors to develop the instruments which fly and collect data from these unique research platforms. The presentation was sprinkled with personal anecdotes, observations and commentary from Roberts' career as a research pilot and manager.



### Dr. Mark Showalter

Carl Sagan Center for Study of Life in the Universe, SETI Institute

*The Discoveries of Pluto's Tiniest Moons*

**Abstract:**

Two small moons of Pluto, currently referred to as "P4" and "P5", were discovered recently in images taken by the Hubble Space Telescope. We now know that four outer moons circle around a central "double-planet" comprising Pluto and its large, nearby moon Charon. The discoveries raise interesting new questions about how the dwarf planet formed. NASA's New Horizons spacecraft will arrive at Pluto in July 2015, and the results come just in time for the science planners to target closeup views of the tiny bodies during the flyby. However, the discoveries also come as a mixed blessing—small moons often raise clouds of dust, prompting concerns about a possible hazard to the spacecraft when it flies through the system at more than 10 km per second. Dr. Mark Showalter led the discovery team for P4 and P5, and presented the latest results.



### Dr. Steve Spangler

Department of Physics and Astronomy, University of Iowa

*Plasmas in Space: From the Sun to the Orbit of the Earth*

**Abstract:**

Dr. Spangler emphasized the aspects of solar and interplanetary physics which are most intriguing, and potentially most important in a broader astronomical and astrophysical context. These topics include remote magnetometry of the solar corona (the highest level in the solar atmosphere), the attempt to discover the mechanisms responsible for heating the solar corona to temperatures as high as 2 million Kelvin, and the properties of turbulence in the solar atmosphere and interplanetary space. He also demonstrated how knowledge gained through study of the Sun and interplanetary medium can contribute to our understanding of much more remote astronomical objects in the Milky Way galaxy and beyond.





## CASPER hosts 19th annual REU and RET summer program

Sponsored by the National Science Foundation, CASPER, the Greater Waco Aviation Alliance, the School of Engineering and Computer Science and the Department of Physics

For the nineteenth year, CASPER hosted an NSF REU (Research Experience for Undergraduates) program and the fourteenth RET (Research Experience for Teachers) program. Eleven undergraduate students and three high school teachers participated in theoretical and experimental research projects under the direction of Mr. Dick Campbell and Dr. Dwight Russell (astronomy), Dr. Gerald Cleaver (string theory), Drs. Truell Hyde, Jie Kong, Lorin Matthews, René Laufer, Ke Qiao and Mr. Jorge Carmona-Reyes (complex plasmas and space science), Dr. Will Anderson (dust transport in turbulent flows) and Drs. Jay Dittmann and Ken Hatakeyama (high energy physics).

Two high school students also participated in summer research at CASPER, modeling ring dynamics and turbulent flows through the High School Summer Science Research Program (HSSSRP) sponsored by the College of Arts and Sciences.

Participating students, teachers, faculty, and graduate students attended weekly Wednesday Lunch Bunch Seminars where the highlight of each week was the Physics

Song Sing-Along. At these Wednesday seminars, faculty presentations on the Physics of Star Trek, the history of space travel in the movies, and Big Data computational techniques alternated with informative talks on how to conduct literature searches, write technical papers, prepare posters and PowerPoint presentations, and apply to graduate school.

On Fridays, participants provided updates on their research experience and practiced their presentation skills, while enjoying refreshments prepared by the fellows themselves.

At the end of the summer, each participant gave a twelve-minute presentation on their research, which was videotaped for use on the CASPER website. The students also prepared a poster and wrote a paper describing their project and the outcomes of their research. Papers can be found online at <http://www.baylor.edu/casper/index.php?id=98835>.

The CASPER Summer program culminated with a dinner and awards presentation at The Palladium, a local venue for private events.

### 2013 NSF REU Fellows

Christopher Barnes, Royal Oak, MI  
Jarrett Brown, Westport, PA  
Peter Fager, Pasadena, TX  
Jonathan Kernes, Evanston, IL  
Jesse Kimery, Bangs, TX  
Kevin Liang, New York, NY  
Kara Merfeld, Bellingham, WA  
Kalvin Ogbuefi, Carson, CA  
Hannah Sabo, Centennial, CO  
Caleb Smith, Colorado Springs, CO  
Kristin Sperzel, Maple Grove, MN

### 2013 NSF RET Fellows

Steve Rapp, Abingdon, VA  
Erica Jones, Baton Rouge, LA  
Lisa Tarman, York, PA



## STUDENT SCHOLARSHIPS

# Baylor/CASPER graduate students earn prestigious Texas Space Grant fellowships

Two Baylor graduate students recently earned fellowships in support of their doctoral study.

Jared Greenwald, doctoral candidate in CASPER through Baylor's department of physics, and Jessica Ubanyionwu in Health Sciences were awarded Texas Space Grant Consortium Graduate Fellowships for the 2013-2014 academic year.

TSGC fellowships are awarded annually to encourage graduate study in science and engineering. Funded by a training grant from NASA, the fellowships provide financial support to students pursuing master's or doctoral degrees in a space science related field at consortium member institutions.

A total of 20 students from 11 Texas universities were awarded fellowships in this year's round of funding.

The Texas Space Grant Consortium is a group of 47 government, industry, education and non-profit institutions in Texas that work to bring the benefits of space research and technology to all Texans.

Baylor and CASPER have been involved in TSGC since the organization's formation, with Baylor and CASPER faculty participating in the proposal for the initial NASA block grant that funds the consortium.

## CASPER ALUMNI UPDATE

# Reaching for the stars: CASPER alumni head non-profit laying groundwork for future interstellar travel



*Icarus Interstellar founders Dr. Richard Obousy (left) and Dr. Andreas Tziolas both earned their Ph.D. degrees at Baylor through CASPER.*

Traveling outside our solar system and visiting nearby stars is a staple of science fiction movies, but until recently, the limitations of current technology have made such travel next to impossible. However, an organization cofounded by a pair of CASPER alumni is now researching methods to move interstellar travel out of the realm of fiction, with the goal of realizing interstellar flight by the year 2100.

Icarus Interstellar is a 501(c)3 nonprofit organization founded by Dr. Richard Obousy and Dr. Andreas Tziolas, both of whom earned their Ph.D. degrees at Baylor through CASPER.

Obousy initially participated as a student in CASPER's Research Experiences for Undergraduates (REU) program. He later returned to Baylor as a graduate student, earning his Ph.D. in theoretical physics in 2008. Tziolas earned his Ph.D. in gravitation and cosmology at Baylor in 2009.

Together, Obousy and Tziolas founded Icarus in 2011 to promote research and public awareness on issues related to the challenges of interstellar travel.

Using current propulsion technology, travel to the nearest stars would take nearly 100,000 years. To help reduce travel time to a duration compatible with a human lifespan, Icarus scientists must find a way to move crafts through space at much faster speeds — up to 5% of the speed of light.

Propelling a rocket that fast with conventional chemical propellants would require more fuel than exists in the known universe, so Icarus scientists are pursuing fusion-based systems for generating energy. They are also working on shielding systems to protect spacecraft from the dangers of interstellar debris, and communication systems that will allow the craft to communicate with Earth over distances of multiple light years.

Overcoming all these limitations won't be easy, but with help from their international collaborators, Obousy and Tziolas are working to make interstellar travel a reality.

To learn more about Icarus Interstellar, visit their website at <http://www.icarusinterstellar.org>.

## Recent Publications

### Peer-reviewed publications (CASPER faculty and collaborators in bold):

- Anderson WC.** An immersed boundary method wall model for high-Reynolds number channel flow over complex topography. *Int J Numer Meth Fluids*. 2012; 71(12):1588-1608. DOI: 10.1002/fld.3727.
- Anderson WC.** Passive scalar roughness lengths for atmospheric boundary layer flow over complex, fractal topographies. *Environ Fluid Mech*. 2013; February 2011; DOI: 10.1007/s10652-013-9272-9.
- Anderson WC,** Passalacqua P, Porte-Agel F, Meneveau C. Large-eddy simulation of atmospheric boundary layer flow over fluvial-like landscapes using a dynamic roughness model. *Boundary-Layer Meteorol*. 2012; 144(2):263-286.
- Beauregard M, Sheng Q.** A semi-adaptive compact splitting method for the numerical solution of 2-dimensional quenching problems. *Appl Math Comput*. 2012; 218:1240-1254.
- Beauregard M, Sheng Q.** An adaptive splitting approach for the quenching solution of reaction-diffusion equations over nonuniform grids. *J Computat Appl Math*. 2013; 241:30-44.
- Beauregard M, Sheng Q.** Explorations and expectations of equidistribution adaptations. *Adv Appl Math Mech*. In press.
- Beauregard M, Sheng Q.** Solving degenerate quenching-combustion equations by an adaptive splitting method on evolving grids. *Comput Struct*. 2013; 122:33-43.
- Briscese F, Marciano A, Modesto L, **Saridakis E.** Inflation in (Super-)renormalizable Gravity. *Phys Rev D*. 2013; 87(8):083507. DOI: 10.1103/PhysRevD.87.083507.
- Cai YF, Gao C, **Saridakis E.** Bounce and cyclic cosmology in extended nonlinear massive gravity. *JCAP* (10) 2012; 048. DOI: 10.1088/1475-7516/2012/10/048.
- Cai Y-F, Easseon DA, Gao C, **Saridakis E.** Charged black holes in nonlinear massive gravity. *Phys Rev D*. 2013; 87(6):064001. DOI: 10.1103/PhysRevD.87.064001.
- Capozziello S, Gonzalez PA, Vasquez Y, **Saridakis E.** Exact charged black-hole solutions in D-dimensional f(T) gravity: torsion vs curvature analysis. *JHEP*. 2013; February; (02) 039. DOI: 10.1007/JHEP02(2013)039.
- Chen RM, **Lenells J,** Liu Y. Stability of the  $\mu$ -Camassa-Holm peakons. *J Nonlinear Sci*. 2013; 23:97–112. DOI: 10.1007/s00332-012-9141-6.
- Donkó Z, **Hartmann P,** Shukla PK. Consequences of an attractive force on collective modes and dust structures in a strongly coupled dusty plasma. *Phys Lett A*. 2012; 376(45):3199. DOI: 10.1016/j.phyleta.2012.08.039.
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- Carmona-Reyes J, Land-Zandstra A**, Cheng J, Douglass A, **Harris B, Zhang Z, Chen M, Matthews LS, Hyde TW**. *The 2012 CASPER Physics Circus*, 54<sup>th</sup> Annual Meeting of the Division of Plasma Physics (American Physical Society), Providence, RI (2012).
- Carmona-Reyes J, Peters S, Herdrich G, Srama R, Schmoke J, Cook M, Matthews LS, Laufer R, Hyde TW**. *Multi Wall Carbon Nano Tubes as Material for a Space Elevator on the Moon*, poster 13<sup>th</sup> Workshop on the Physics of Dusty Plasmas, Waco, TX, May 20-23, 2012.
- Casey S**. *Space Entrepreneurship in Silicon Valley*, Next Generation Suborbital Researchers Conference, June 3-5, 2012.
- Cleaver G**. *Automated Systematic Generation of Flat Directions in Free Fermionic Heterotic Strings*, PASCOS, 2012.
- Cleaver G**. *Systematic Construction of Free Fermionic Heterotic String Gauge Models*, PASCOS, 2012.
- Cleaver G**. *Propulsion via Chiral Fermion Pair production from Parallel Electric and Magnetic Fields*, NASA 100 YSS Symposium, Houston, TX, September 2012.
- Cleaver G**. *Systematic Investigations of the Heterotic String Landscape*, String Phenomenology, Cambridge, England, July 2012.
- Cleaver G**. *The Infinite in String Cosmology*, Michigan State University, October 2012.
- Cleaver G**. *Multiverse Implications*, Faraday Center, Cambridge, England, July 2012.
- Davis A, **Carmona-Reyes J, Matthews LS, Hyde TW**, *Dynamics of Dust Aggregates in a Complex Plasma*, poster 54<sup>th</sup> Annual Meeting of the APS Division of Plasma Physics, Providence, RI, October 29-November 2, 2012.

## Presentations, cont.:

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- Dropmann M, Laufer R, Herdrich G, Hyde TW, Cook M, Schmoke J**. *Lunar Environment Simulation Capabilities at CASPER*, Lunar and Planetary Science XXXIV, Lunar and Planetary Science Conference, Houston, TX (CD-ROM) (2013).
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- Frazier SA, Matthews LS, Hyde TW**. *Charging Behavior of Dust Aggregates in a Cosmic Plasma Environment*, poster 44<sup>th</sup> Lunar and Planetary Science Conference, The Woodlands, TX, March 2013.
- Kong J, Qiao K, Carmona-Reyes J, Douglass A, Zhang Z, Matthews LS, Hyde TW**. *Using Falling Dust Particles as In-Situ Probes to Measure the Vertical Electric Force Distribution in a Complex Plasma*, 54<sup>th</sup> Annual Meeting of the Division of Plasma Physics (American Physical Society), Providence, RI (2012).
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- Herdrich G, Winter M**. *Non-equilibrium Instrumentations to assess Atmospheric Entry*, Gordon Research Conference on Atmospheric Reentry Physics, Ventura, CA, February 2013.
- Herdrich G, Bauder U, Boxberger A, Gabrielli R, Lau M, Le QH, Syring C, Schönherr T, Komurasaki K**. *Elektrische Raumfahrtantriebe (am IRS)*, eingeladenes Vortrag, Technische Universität München, April 2013.
- Herdrich G**. *Elektrische und fortschrittliche Raumfahrtantriebe (am IRS)*, Vortrag Raumfahrt aus Leidenschaft, IRS, Stuttgart, June 13, 2013.
- Hyde TW, Kong J, Chen M, Qiao K, Harris B, Douglass A, Carmona-Reyes J, Matthews LS**. *Collective Phenomena in Extended Particles Chains Within a Complex Plasma*, 54<sup>th</sup> Annual Meeting of the Division of Plasma Physics (American Physical Society), Providence, RI (2012).
- Hyde TW**. *Collective Effects in Extended Vertical Chains in Dusty Plasmas*, presented at EPS / ICPP 2012 (European Physical Society), Stockholm, Sweden (2012).

## Presentations, cont.:

- Hyde TW, Laufer R, Herdrich G, Dropmann M, Peters S, Gomringer C, Koch H, Matthews LS, Cook M, Schmoke J.** *A New Inductively Driven Plasma Generator*, Thirteenth Workshop on the Physics of Dusty Plasmas, Waco, TX (2012).
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- Klaus K.** *Vacuum energies in spherically symmetric background potentials revisited*, Quantum Vacuum Workshop, TX A&M, May 15-16, 2013.
- Koch H, **Dropmann M, Herdrich G, Cook M, Schmoke J, Laufer R, Hyde TW.** *Development of a Pitot Probe for Diagnostic Applications in the Dusty Plasma Environments Created by the Inductively-Heated Plasma Generator*, Thirteenth Workshop on the Physics of Dusty Plasmas, Waco, TX (2012).
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- Kong J, Qiao K, Zhang Z, Douglass A, Harris B, Hyde TW, Matthews LS.** *Vertical Dust Chain Breathing Mode Frequency and the Dust Charge Distribution*, Thirteenth Workshop on the Physics of Dusty Plasmas, Waco, TX (2012).
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- Land V, **Matthews LS, Ma T, Perry J, Hyde TW.** *Dust Aggregation in Protoplanetary Disks in the Presence of Plasma Charging, UV Charging and Secondary Electron Emission*, Dust and Grains in Low Gravity and Space Environment Workshop, ESA/ESTEC, Noordwijk, the Netherlands (2012).
- Laufer R.** *Lecture on Planetary Exploration*, Descriptive Astronomy (D. Russell), February 2013.
- Laufer R.** *Status on the Activities of the IAA Permanent Committee on Small Satellite Missions*, IAA Academy Day Naples, Italy, September 2012.
- Laufer R.** *A Modular, Miniaturized, Low-mass In-situ Dust Detector for Piggyback Payload Opportunities on Small Spacecraft, Landers and Rovers*, IAC, Naples, Italy, October 2012.
- Laufer R.** *Status on the Activities of the IAA Permanent Committee on Small Satellite Missions*, IAA Spring Meeting, Paris, France, March 18, 2012.
- Laufer R.** *The Earth Micro- and Submicro-Particle Environment*, 39<sup>th</sup> COSPAR, Mysore, India, July 2012.
- Laufer R.** *In-Situ Dust Measurements by a Lunar Lander*, 39<sup>th</sup> COSPAR, Mysore, India, July 2012.
- Laufer R.** *A Low-cost, Modular, Miniaturized In-situ Measurement Instrument for Sub-millimeter Detection*, German Aerospace Congress 2012, Berlin, Germany, September 2012.
- Laufer R.** *A simple approach to the public acceptance of technological projects*, IAC, Naples, Italy, October 2012.
- Laufer R.** *An affordable paradigm of hitchhiker lunar and planetary spacecraft for exploration and commerce*, IAC, Naples, Italy, October 2012.
- Laufer R.** *Initial Operation of the Miniaturized Inductively Heated Plasma Generator IPG6*, 54<sup>th</sup> Annual Meeting of the APS Division of Plasma Physics, Providence, RI, October 29-November 2, 2012.
- Laufer R.** *A Piezo-based Particle Detection System for Ground and Space Applications*, IAA Symposium, Berlin, Germany, April 2013.
- Laufer R.** Seminar, Konrad Adenauer Foundation (KAS), Potsdam, Germany, June 2012.
- Laufer R.** Lecture, Technical Univ. Braunschweig (TU-BS), Braunschweig, Germany, April 2013.
- Laufer R.** Lectures, Technical Univ. Dresden (TUD), Dresden, Germany, June & December 2012.
- Laufer R.** Lectures, Univ. Stuttgart, Institute of Space Systems (IRS), Stuttgart, Germany, June & December 2012, March 2013.
- Lenells J.** *The Fokas method for equations with 3x3 Lax pairs, Boundary value problems for linear elliptic and integrable PDEs: theory and computation*, ICMS, Edinburgh, Scotland. June 2012.



## Presentations, cont.:

- Lenells J.** *Boundary value problems for the stationary axisymmetric Einstein equations, Algebro-geometric methods in fundamental physics*, 515th WE-Heraus-Seminar, Physikzentrum Bad Honnef, Bad Honnef, Germany. September 2012.
- Lenells J.** *Exact solutions of the Einstein equations*. Frank Stones Memorial Colloquium Lecture at Texas Christian University, Fort Worth, TX. September 2012.
- Matthews LS**, Shotorban B, **Hyde TW**. *Effect of Stochastic Charging on Cosmic Dust Aggregation*, Lunar and Planetary Science XXXIV, Lunar and Planetary Science Conference, Houston, TX (CD-ROM) (2013).
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- Matthews LS**, **Ma T**, **Perry J**, Land V, **Hyde TW**. *Charging of dust aggregates in astrophysical environments*, Dust and Grains in Low Gravity and Space Environment Workshop, ESA/ESTEC, Noordwijk, the Netherlands (2012).
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- Qiao K**, **Kong J**, **Zhang Z**, **Matthews LS**, **Hyde TW**. *Mode Coupling and Resonance Instabilities in a Horizontal Finite Dust Chain*, 54<sup>th</sup> Annual Meeting of the Division of Plasma Physics (American Physical Society), Providence, RI (2012).
- Sandau R**. *Small Satellites – Status, Opportunities and Challenges*, XXII ISPRS Congress, Melbourne, Australia. August 25-September 1, 2012.
- Sandau R**. *Opportunities and Challenges of Small Satellites for Earth Observation*, The Eighth National GIS Symposium in Saudi Arabia – The Road for Building Saudi Arabia GIS, Dammam, Saudi Arabia, April 15-17, 2013.
- Sandau R**. *Small Satellites - Status , Opportunities and Challenges*, ICEO&SI 2013, International Conference on Earth Observations and Societal Impacts, Tainan, Taiwan, June 23-25.
- Saridakis E**. *Horava-Lifshitz Gravity*, IAP, Paris France.
- Saridakis E**. *Horava-Lifshitz Gravity and Cosmology*, IphT, Saclay, Paris, France.
- Saridakis E**. *F(T) Gravity and Cosmology*, Estadual Paulista U., Paulo, Brazil.
- Saridakis E**. *F(T) Gravity and Cosmology*, Valparaiso U. Chile.
- Saridakis E**. *Torsional Gravity and Cosmology*, U. Central de Chile, Santiago, Chile.
- Saridakis E**. *New Massive Gravity and Cosmology*, Nat. Tsing Hua U. Taiwan.
- Saridakis E**. *New Massive Gravity and Cosmology*, Natl. Taiwan U. Taiwan.
- Saridakis E**. *Teleparallel, Torsional and f(T) Gravity*, Bad Honnef, Germany.
- Saridakis E**. *F(T) Gravity and Cosmology*, City College of New York, NY.
- Saridakis E**. *F(T) Gravity and Cosmology*, McGill U. Canada.
- Saridakis E**. *New Massive Gravity and Cosmology*, Crete U. Greece.
- Saridakis E**. *F(T) Gravity and Cosmology*, Athens U. Greece.
- Sheng T**. *Efficient numerical methods for highly oscillatory wave problems*, Department of mathematics, Baylor University, April 24, 2013.
- Sheng T**. *On split mesh adaptation for singular differential equations*, Eighth IMACS International Conference on Nonlinear Evolution Equations and Wave Phenomena: Computation and Theory, Athens, GA, March 25-28, 2013.
- Sheng T**. *On degenerate combustion modeling and solution procedures*, Fourteenth SIAM International Conference on Numerical Combustion, San Antonio, TX, April 8-10, 2013.

## Presentations, cont.:

Ulrich S, **Anderson WC**, Passalacqua P, Mohrig D, Kocurek G. Large-eddy Simulation of Boundary Layer Flow over Desert Sand Dune Structures. *Proc. of American Geophysical Union, Fall Meeting*, San Francisco, CA (2012).

## Proceedings/conferences:

**Anderson WC**. Evaluation of passive admixture interfacial transfer coefficient relations during LES of ABL flow over self-similar, fractal topography. *Proceedings of American Meteorological Society, 20th Symp. on Boundary Layers and Turbulence*, Boston, MA (2012).

**Anderson WC**. Evaluation of scalar and momentum roughness lengths in ABL flow over complex terrain. *Proceedings of the annual meeting of the American Geophysical Union*; 2013 December 9-13; San Francisco, CA.

**Anderson WC**, Christensen KT. LES of turbulent boundary layer flow over complex topographies and comparison with experimental data. *Proceedings of the 65<sup>th</sup> annual meeting of the American Physical Society, Division of Fluid Dynamics*; 2012 November 18-20; San Diego, CA.

**Anderson WC**. LES of the atmospheric boundary layer responding to protruding fractal-like topography. *Proceedings of the 20<sup>th</sup> Symposium on Boundary Layers and Turbulence*; 2012 July 9-13; Boston, MA.

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**Boehm K, Laufer R, Herdrich G, Przybiski O, Hyde TW, Roeser H-P**. Design of a 2-Second Drop Tower Facility for Small Satellite Technology Demonstration and Microgravity Research. *Proceedings of the 9<sup>th</sup> International Academy of Astronautics Symposium*; 2013 April 8-12; Berlin, Germany. Stuttgart, Germany: German Aerospace Center (DLR).

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**Chen M, Kong J, Qiao K, Carmona-Reyes J, Harris B, Matthews LS, Hyde TW**. Particle Hopping within an Extended Vertical Chain in a Complex Plasma. *Proceedings of the 54<sup>th</sup> annual meeting of the American Physical Society, Division of Plasma Physics*; 2012 October 29-November 2; Providence, RI.

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**Dropmann M, Herdrich G, Laufer R**, Koch H, Gomringer C, **Cook M, Schmoke J, Matthews LS, Hyde TW**. Initial Operation of the Miniaturized Inductively Heated Plasma Generator IPG6. *Proceedings of the 54<sup>th</sup> annual meeting of the American Physical Society, Division of Plasma Physics*; 2012 October 29-November 2; Providence, RI.

**Dropmann M, Herdrich G, Laufer R**, Koch H, Gomringer C, **Cook M, Schmoke J, Matthews LS, Hyde TW**. A simple approach to the public acceptance of technological projects. *Proceedings of the 54<sup>th</sup> annual meeting of the American Physical Society, Division of Plasma Physics*; 2012 October 29-November 2; Providence, RI.

**Jochum A**, Beyermann U, **Laufer R**, Kuwahara T, **Hyde TW, Roeser, H-P**. Design of a Satellite Ground Station within a Global Network. *Proceedings of the 9<sup>th</sup> International Academy of Astronautics Symposium*; 2013 April 8-12; Berlin, Germany. Stuttgart, Germany: German Aerospace Center (DLR).

**Kong J, Qiao K, Carmona-Reyes J, Douglass A, Zhang Z, Matthews LS, Hyde TW**. Using Falling Dust Particles as In-Situ Probes to Measure the Vertical Electric Force Distribution in a Complex Plasma. *Proceedings of the 54<sup>th</sup> annual meeting of the American Physical Society, Division of Plasma Physics*; 2012 October 29-November 2; Providence, RI.

**Laufer, R**. A Piezo-based Particle Detection System for Ground and Space Applications. *Proceedings of the 9<sup>th</sup> International Academy of Astronautics Symposium*; 2013 April 8-12; Berlin, Germany. Stuttgart, Germany: German Aerospace Center (DLR).

McClain S, Mart S, **Anderson WC**. Roughness temporal response in a turbulent thermal boundary layer. *Proceedings of American Inst. of Aero. and Astro., 6th Flow Control Conf.*, New Orleans, LA. (2012).

Meneveau C, **Anderson WC**. Dynamic surface roughness model for LES of atmospheric boundary layer flow over multi-scale terrain with power-law height spectra. *Proceedings of European Geosciences Union, General Assembly*, Vienna, Austria. (2012).

## Proceedings/conferences, cont.:

- Qiao K, Kong J, Zhang Z, Matthews LS, Hyde TW.** Mode coupling and resonance instabilities in a horizontal finite dust chain. *Proceedings of the 54<sup>th</sup> annual meeting of the American Physical Society, Division of Plasma Physics*; 2012 October 29-November 2; Providence, RI.
- Sandau R, Roeser H-P.** Valenzuela A, editor. Small Satellites for Earth Observation. *Proceedings of the 9<sup>th</sup> International Symposium of the International Academy of Astronautics*; 2013 April 8-12; Berlin, Germany. German Aerospace Center (DLR): June 2013.
- Sandau R.** Conference Chair: *9<sup>th</sup> International Symposium of the International Academy of Astronautics*, Berlin, April 8-12, 2013.
- Sandau R, Roeser H-P.** Valenzuela A, editor. Small Satellites for Earth Observation. *Digest of the 9<sup>th</sup> International Symposium of the International Academy of Astronautics*; 2013 April 8-12; Berlin, Germany.
- Srama R,** Gruen E, Krueger H, **Laufer R, Roeser H-P.** The Earth Micro- and Submicro-Particle Environment. *Proceedings of the 39<sup>th</sup> Committee on Space Research, Scientific Assembly*; 2012 July 14-22; Mysore, Karnataka, India.
- Srama R,** Kempf S, Sternovsky Z, Gruen E, Fiege K, Horanyi M, Moragas-Klostermeyer G, Krueger H, **Laufer R,** Li Y, Mocker A, Postberg F, **Roeser H-P.** In-Situ Dust Measurements by a Lunar Lander. *Proceedings of the 39<sup>th</sup> Committee on Space Research, Scientific Assembly*; 2012 July 14-22; Mysore, Karnataka, India.
- Stanley JC, Cade III WB.** Space weather effects on aircraft navigation. *Proceedings of the annual meeting of the American Geophysical Union*; 2013 December 9-13; San Francisco, CA.
- Uhlrich S, **Anderson WC,** Kocurek G, Mohrig D. Large-eddy simulation of atmospheric surface layer flow over crescentic, aeolian sand dunes at the White Sands National Monument. *Proceedings of the Texas Symposium on Fluid Dynamics*; 2013 May 3-5; Burnet, TX.
- Uhlrich S, **Anderson WC,** Passalacqua P, Mohrig D, Kocurek G. Large-eddy Simulation of Boundary Layer Flow over Desert Sand Dune Structures. *Proceedings of the annual meeting of the American Geophysical Union*; 2013 December 9-13; San Francisco, CA.
- Willingham D, **Anderson WC.** Turbulent boundary layer flow over transverse roughness heterogeneities: Induced mixing and flow characterization. *Proceedings of the Texas Symposium on Fluid Dynamics*; 2013 May 3-5; Burnet, TX.
- Wolf A, Laufer R, Srama R, Herdrich G,** Lightsey EG, Wiedemann C, **Hyde TW, Roeser H-P.** A Modular, Miniaturized, Low-mass In-situ Dust Detector for Piggyback Payload Opportunities on Small Spacecraft, Landers and Rovers. *Proceedings of the 63<sup>rd</sup> International Astronautical Congress*; 2012 October 1-5; Naples, Italy.
- Wolf A, Laufer R, Srama R, Hyde TW, Roeser H-P.** A Low-cost, Modular, Miniaturized In-situ Measurement Instrument for Sub-millimeter Detection. *Proceedings of the German Aerospace Congress*; 2012 Sep 10-12; Berlin, Germany.
- Anderson WC.** Mechanical Engineering Department, Texas Tech University, Lubbock, TX, March 26, 2013.
- Herdrich G,** Boxberger A, Lau M, Le QH, Syring S, Gabrielli R, Fasoulas S. *Magnetoplasmadynamic Thrusters* (Special Session), XXXI ICPIG, Granada, Spain, July 14-19, 2013.
- Herdrich G.** *Past AVT Panel Lessons Learnt*, RTO Specialist Meeting, VKI, Brussels, October 2012.
- Anderson WC.** Mechanical Engineering Department, Baylor University, Waco, TX, September 2012.
- Anderson WC.** *Aerospace Engineering and Engineering Mechanics*, The University of Texas at Austin, Austin, TX, February 21, 2013.



## Invited talks, cont.:

- Hyde TW.** *System confinement and symmetry-breaking in vertically aligned dust structures*, American Physical Society DPP, Denver, CO (2013).
- Hyde TW.** *Projects and Research at CASPER - Complex (Dusty) Plasma Physics Academic and Scientific Collaborators of the Institute of Space Systems*, at the opening of their new building, Institut für Raumfahrtssysteme, Univ. of Stuttgart, Stuttgart, Germany (2011).
- Hyde TW.** *Helical Structure within a Vertically Aligned Dust Particle Chain*, The 2013 Princeton Summer School on Quantum Science and Engineering, Casper, WY (2013).
- Laufer R.** *Lunar Exploration*, Univ. Stuttgart, Germany, June 2012.
- Laufer R.** *Future Lunar Missions*, Technical Univ. Dresden, Germany, December 2012.
- Laufer R.** *Lunar Mission BW1*, Univ. Stuttgart, Germany: December 2012.
- Laufer R.** *Future Lunar Missions*, Technical Univ. Dresden, Germany, June 2012.
- Laufer R.** *Space and Culture, Space in Movies, Space in Various Media*, Konrad Adenauer Foundation, Potsdam, Germany, June 2012.
- Laufer R.** *Planetary Probe Design Workshop*, Univ. Stuttgart, Germany: March 2013.
- Laufer R.** *Explorative and Short Duration Small Satellite Missions*, Technical Univ. Braunschweig, Germany, April 2013.
- Sandau R.** *J.-M. Contant: A Steppingstone for Global Space Cooperation*, XXII ISPRS Congress, August 25-September 1, 2012.
- Sandau R.** *Quo Vadis? Small Satellites/CubeSats*. 2<sup>nd</sup> IAA Conf. University Satellite Missions, Roma, Italy, February. 3-9, 2013.
- Sandau R.** *Small Satellite Missions – Quo Vadis*, Digest of the 9<sup>th</sup> International Symposium of the International Academy of Astronautics, Berlin, Wissenschaft und Technik Verlag, Berlin, 2013, ISBN 978-89685-574-9, April 8-12, 2013.
- Sandau R.** *Global Space Cooperation – New Activities for Disaster Management and Climate Change*, ISPRS Hannover Workshop 2013 on High-Resolution Earth Imaging for Geospatial Information, Hannover, Germany, May 21 - 24, 2012.
- Sandau R.** *The Impact of Small Satellites on Earth Observation Applications*, ICEO&SI 2013, International Conference on Earth Observations and Societal Impacts, Tainan, Taiwan, June 23-25, 2012.
- Sheng T.** *The ADI method and its matrix challenges*, Mini-Workshop on Scientific Computing, Macau, China, July 25-26, 2012.
- Sheng T.** *Parallel and split finite difference and finite element strategies for highly oscillatory optical waves*, Mathematics Colloquium, University of Pittsburgh, PA, April 12, 2013.
- Sheng T.** *From ray decomposition to evaluations of the Helmholtz solutions*. Mathematical Colloquium, Sun Yat-Sen University, Guangzhou, China, July 27, 2012.
- Sheng T.** *On fast approximations of Stratton-Chu scattering diffraction integrals*. Mathematics Colloquium, Southeast University, China, December 18, 2012.
- Sheng T.** *Adaptive methods for singular and splitting problems in multiphysics applications*. Applied Mathematics Colloquium, University of Texas, TX, March 29, 2013.

## Books:

- Sandau R**, Nakasuka S. Kawashima R, Sellers, J, editors. Novel Ideas for Nanosatellite Constellation Missions. *International Academy of Astronautics Book Series; Volume 1, Number 1*; Paris, France: International Academy of Astronautics: 2012.

## Book Chapters:

- Sandau R.** *Focused Section on Aerospace Mechatronics*. In Press 2013.

## Outreach Publications:

- Cleaver G.** *What is the Higgs Boson?*, The Forum: BioLogos website, 2012.

# News and notes on CASPER members and their families

## Babies



### Claire Elizabeth Anderson

Born Jan. 7, 2013 to William and Brittney Anderson.

She weighed 6 lbs, 9 oz and was 20.5" long.



### Fabian Herdrich

Born Feb. 6, 2013 to Georg and Andrea Herdrich.

He weighed 6 lbs, 14 oz and was 20" long.



### Silke Lotte Land

Born May 15, 2013 to Victor and Anne Land.

She weighed 9 lbs, 8 oz and was 22" long.

## Graduations

Congratulations to **Jared Greenwald**, who successfully defended his dissertation, *Automated Systematic Generation and Exploration of Flat Direction Phenomenology in Free Fermionic Heterotic String Theory*, and graduated from Baylor with the Ph.D. in physics in December 2013.

Congratulations to **Yongqing Huang**, who successfully defended his dissertation, *Horava-Lifshitz Theory of Gravity and Its Applications to Cosmology*, and graduated from Baylor with the Ph.D. in physics in May 2013.

## Former CASPER member's son enrolls at Baylor University

CASPER welcomes **Sean Yarborough**, who arrived at Baylor as a physics major in the fall of 2013. Sean's father, **Brian Yarborough**, was a CASPER intern, making Sean the first (as far as we know) second-generation CASPER scholar!

## EUCOS grad joins national lab

Two days after successfully defending his dissertation, **Jared Greenwald**, a member of Dr. Cleaver's Early Universe Cosmology and String Theory group, and his wife, Abby, moved to Albuquerque, New Mexico, where Jared began a postdoctoral research position at Sandia National Laboratories.

At Sandia, a federal lab under the management of Lockheed-Martin, Greenwald will be working in a division responsible for international nuclear test ban treaty verification. While initially a two-year postdoctoral fellowship, his job holds the potential to transform into a long-term position.

Dr. Cleaver and his research group congratulate Jared on his successful dissertation defense and job acquisition.

## What's new?

We want to hear from you!

If you or another current or former CASPER member has a new job, new project, or a new addition to the family, tell us about it!

Send an email to [research@baylor.edu](mailto:research@baylor.edu) with the subject, "CASPER Update."





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Baylor Research and Innovation Collaborative (BRIC)  
100 Research Parkway, Suite 1102  
Waco, TX 76704  
<http://www.baylor.edu/CASPER>  
(254) 710-3763 (voice)  
(254) 867-3167 (voice)  
(254) 710-7309 (fax)

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