

CASPER

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



Artifacts from NASA missions find new home at the BRIC

Satellite and other materials to be incorporated into design of Discovery Park

The National Aeronautics and Space Administration has awarded CASPER and Baylor's Office of the Vice Provost for Research (OVPR) over 50 different artifacts for display within the Baylor Research and Innovation Collaborative (BRIC). The artifacts include space shuttle components and materials from experiments flown on shuttle missions.

Truell Hyde, Baylor vice provost for research, Carliss Hyde, vice president for development at TSTC Waco and David Pryor, vice president and general manager of Central Transportation Systems, were on hand at TSTC when Central Transportation delivered the latest of these artifacts from a unique NASA experiment called the Tethered Satellite System (TSS). Versions of the TSS flew on the 46th and 75th space shuttle missions in 1992 and 1996.

The TSS consists of a satellite, a conducting tether, and a tether deployment/retrieval system. The TSS released a satellite while remaining attached to a reel in the orbiter payload bay. This mission was intended to demonstrate control of the satellite during deployment, aerodynamic stability at flight altitude, and the ability of the system to collect meaningful scientific data and return the data to the Orbiter, and then to the Payload Operations Control Center.

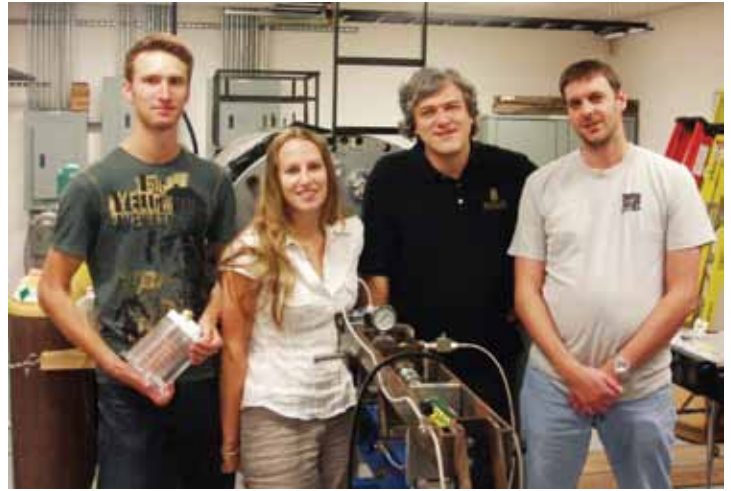
The satellite was to be deployed 20 km (12.5 miles) above the Orbiter. The deploying equipment consisted of a Spacelab pallet, a reel for tether deployment, an extendible/retractable boom for initial deployment and final retrieval of the satellite, an electrical power and distribution subsystem, a communications and data management subsystem, and a tether control capability. A separate support structure carried science instrumentation.

The components to be displayed in the BRIC measure 14 feet long, 10 feet wide and over 10 feet high. BRIC partner TSTC Waco will provide temporary storage for the parts while BRIC architect, Perkins+Will, and Baylor Facility, Planning and Construction Services complete architectural designs incorporating the TSS and other shuttle artifacts into the 300,000-square-foot BRIC facility.

The TSS and other NASA artifacts will serve as unique markers for both visitors and scientists while enhancing science, technology, engineering and math education and research programs for K-12 students conducted in the BRIC.

(Pictured top-left, a NASA illustration of the TSS in operation; center, the TSS equipment unloading at TSTC; top-right, Dr. Truell Hyde discusses the equipment with local media)

First light for CASPER's new plasma generator



In December 2011, CASPER researchers successfully operated the new inductively heated plasma generator (IPG6-B) at the CASPER lab on the TSTC campus.

The IPG6-B is part of the existing collaboration between CASPER and the Institute of Space Systems at the University of Stuttgart, Germany.

The two universities are working together to establish a Hybrid Plasma Simulation Facility, designed to perform complex plasma research for both space and terrestrial applications, including simulations of deep space, lunar and cometary environments.

The research will also help CASPER researchers investigate complex dusty plasma interaction of blanket material in fusion reactor walls and biowaste management.

The IPG6-B is based on a proprietary, electrodeless Stuttgart plasma generator design. It is exclusively licensed in North

America to CASPER as part of a joint research agreement with adjunct faculty Dr. Georg Herdrich (Univ. Stuttgart/CASPER) in the area of plasma technology. CASPER's IPG6-B is part of a twin system with another IPG6-B at the Institute of Space Systems in Stuttgart.

Exchange students from Germany will continue to be involved in various projects related to construction of the Hybrid Plasma Simulation Facility as part of their graduate research.

Plans for the IPG6-B at CASPER include operation in a stand-alone fashion, or in combination with CASPER's existing light gas guns. Diagnostics and a sidearm system are currently under development.

(Pictured top-left, the IPG6-B in operation; top-right, German research fellows Michael Dropmann and Susanne Peters, research faculty René Laufer, and CASPER senior technician Jimmy Schmoke in front of the plasma generator chamber with light gas gun)

CASPER, UT Dallas extend memorandum of understanding

The existing collaboration in the field of space sciences between CASPER and the University of Texas at Dallas was recently extended until 2015.

Through CASPER, Baylor has a proud heritage in space physics and engineering, and UT-Dallas boasts an equally impressive history through the William B. Hanson Center for Space Sciences.

UT-Dallas faculty have fielded four space instruments on major NASA and U.S. Department of Defense projects over the past several years. They have extensive experience and experimental capability in the design, manufacture and preparation of instruments for space flight.

The collaboration, originally conceived to support joint activities and projects between CASPER and the Hanson Center, has now been expanded to support collaboration in other areas in the field of physics as well.

Dr. David Lary, associate professor in the UT-Dallas department of physics, is the primary point of contact at UT-Dallas. Dr. Lary and his group perform research in remote sensing and computational investigations in Earth sciences using small robotic airborne platforms.

(During a CASPER seminar in the fall of 2011, Dr. Lary presented his research activities and shared recent results.)

New BRIC facility to bring CASPER under one roof by 2013

A symbolic shift from 20th-century manufacturing to 21st-century technology took place in Waco, Texas with the October, 2009, announcement of plans to turn a long-shuttered manufacturing plant into a modern research, workforce development, advanced manufacturing and industrial collaborative.

The Baylor Research and Innovation Collaborative (BRIC) is located within the Central Texas Technology and Research Park (CTTRP), situated on approximately 21 acres at South Loop Drive in Waco.

The BRIC is the park's first project and is housed in the former General Tire facility, an existing 300,000 square foot building.

The design effort to renovate the BRIC building is well underway, with completion of Phase One construction scheduled for March, 2012. Phase Two construction, which includes build-out of the CASPER lab, theory group areas and office space, is scheduled for completion by January, 2013. Following its move to the world-class BRIC facility in late 2012, CASPER will be housed under one roof for the first time in its history.



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

ASSTG and HIDPL Group members attended the 52nd Annual Meeting of the American Physical Society's Division of Plasma Physics in Chicago, Illinois, November 8-12, 2010. The group delivered nine scientific presentations and posters at the event.

Dr. Victor Land participated in the 2nd Graduate Summer Institute "Complex Plasmas" held in Greifswald, Germany, from August 5-13, 2010. Close to twenty lecturers from Germany, Hungary, the United Kingdom, and the United States presented overviews, as well as talks on state-of-the-art research in the fields of magnetic confinement fusion, dusty plasma, chemically active plasma, solid state plasma and micro-plasma. Another highlight included a visit to the construction site of Wendelstein 7-X, a next-generation stellarator fusion experiment at the Max Planck Institute for Plasma Physics.

Group members traveled to Salt Lake City, Utah, to attend the 53rd Annual Meeting of the APS Division of Plasma Physics, November 14-18, 2011. Group members presented seven talks and three posters during the conference. Two of this summer's CASPER REU participants, Autumn Paro and Erin Middlemas, also attended the conference.

Dr. Lorin Matthews was a participant at the 23rd Annual Kavli Frontiers of Science Symposium, sponsored by the National Academy of Sciences, in Irvine, California, November 17-19, 2011. The Kavli Frontiers of Science program brings together some of the very best young scientists to discuss the challenges and opportunities of vastly different fields such as astrophysics, nanoscience, neuroscience, and theoretical physics. Dr. Matthews presented a poster on her research, titled *Coagulation of Dust Particles in Plasma*.

Gravity, Cosmology & Astroparticle Physics Group (GCAP)

The GCAP group experienced growth and productivity in 2011. Dr. Antonino Flachi arrived in November to work as a research assistant professor within CASPER. He will work together with Drs. Gerald Cleaver, Klaus Kirsten, Qin (Tim) Sheng and Anzhong Wang. Dr. Wang also recently received an additional \$10,000 grant from the Department of Energy to support his graduate students during the summer of 2012.

A number of GCAP faculty members presented at national and international conferences this year, including the AMS Spring Central Section Meeting at the University of Iowa, the Quantum Vacuum Workshop at the University of Oklahoma, the Tenth Conference on Quantum Field Theory under the Influence of External Conditions in Benasque, Spain and the Annual Meeting of Chinese Gravitational Physics and Astrophysics in Datong, China.

EAG Members

Faculty and Staff

Dwight Russell Dick Campbell

Undergraduate Student

Kimberly Orr

ASSTG/SSL/HIDP Members

Faculty and Staff

Truell Hyde	Victor Land
Lorin Matthews	René Laufer
Jie Kong	Jorge Carmona-Reyes
Ray Nazzario	Michael Cook
Ke Qiao	Jimmy Schmoke

Adjunct Faculty

Phillip Anz-Meador	Georg Herdrich
John Fitch	Rainer Sandau
Peter Hartmann	Ralf Srama

Graduate Students

Mudi Chen	Theresa Ma
James Creel	Jay Murphree
Angela Douglass	Jonathan Perry
Brandon Harris	Victor Zhang

Interns

Jason Brown	Salvador Lopez
Anthony Burns	Jeffrey Mullen
Deanna Craig	Robert Tibbs
Michael Daughtry	Jonathan Whitely
Alan Kilgore	Aaron Westbrook

Undergraduate Students

Kristen Deline	Stephen Pickett
Brandon Doyle	

GCAP Members

Faculty and Adjunct Faculty

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

Graduate Students

Yongqing Huang	V.H. Satheeshkumar
Pedro Morales	Raziyeh Yousefi

Undergraduate Student

Janie Hoormann

Early Universe Cosmology and Strings Research Group

Dr. Jerry Cleaver was recently invited to be a member of the Texas Education Agency's State Review Panel for Supplemental Science Material Adoption. Dr. Cleaver was on a committee evaluating physics and integrated physics/chemistry material to verify that the submissions meet the minimum content guidelines as set forth by TAKS standards.

William Hicks, a 2011 CASPER REU student, has been invited to present *Algorithm for Developing $U(1)$ Charges in Free Fermionic Heterotic String Models*, by William Hicks, Leslie Vestal, Jared Greenwald, Doug Moore, Tim Renner, and Gerald Cleaver, at the AAAS 2012 Emerging Researchers National Conference in STEM in Atlanta, Georgia on February 23-25, 2012. The paper has been submitted to the Journal of Undergraduate Research in Physics and can be downloaded from arXiv:1108.4082. Constructing the described algorithm was the summer REU project of Hicks and Vestal.

EUCOS Members

Faculty and Staff

Gerald Cleaver Qin (Tim) Sheng
Klaus Kirsten

Graduate Students

Yanbin Deng Douglas Moore
Jared Greenwald

Undergraduate Student

Cameron Buescher

RESEARCH UPDATES

CASPER postdoc contributes to Dutch museum blog

Dr. Victor Land was recently selected to write a series of articles for the science museum MUSEON, located in the Netherlands. The Dutch-language blog features articles on a variety of science-related topics for a general audience. Dr. Land's involvement provides valuable international exposure for CASPER and the research of the center's faculty and staff.

In a recent post, Dr. Land discussed The Drake Equation and using computer models to simulate planetary formation:

How many intelligent civilizations are there in our galaxy? An equation that gives an estimate, the Drake equation, was first recorded by astronomer Frank Drake. The answer is a product of a lot of estimates, including the number of stars in our galaxy and the probability that a star has planets around it.

The way planets form around stars is one of the questions that we deal with in CASPER. Stars form from clouds of gas and dust that collapse under their own weight. The gas cloud is collapsed into a star and also a disk of dust and hot gas, which we call the proto-planetary disk. The secret ingredient for planets is dust in the disk of hot gas.

Tiny particles, smaller than a human hair, clash together in eddies of gas and form ever larger aggregates. The gas is so hot that it creates a plasma, a mixture of atoms and charged particles. The aggregates absorb plasma particles and thus become electrically charged. The electric force between charged particles affects the collisions.

In computer models, we calculate the charge on the aggregates. Hundreds of collisions ultimately form an aggregate half a millimeter across, consisting of 2000 packed particles. These particles are rather "woolly" objects, like the dust under your bed. Their shape is very reminiscent of the computer-generated fractals and they have a much larger area than a compact sphere with the same number of particles.

Attempting to answer Drake's question about intelligent life in the universe begins with computer simulation of planetary formation.

Baylor hosts workshop for mathematics research

In September, 2011, CASPER member Dr. Tim Sheng hosted a workshop for researchers with interests in numerical modeling.

The Baylor Workshop on Splitting and Multiscale Methods for Computational PDEs brought students and faculty members from across the nation to Waco to stimulate new ideas and collaboration in this area of computational mathematics.

Plenary speakers for the workshop included Yalchin Efendiev (Texas A&M), Bjorn Engquist (UT Austin), Roland Glowinski (Univ. of Houston), Jan S. Hesthaven (Brown Univ.), Arieh Iserles (Univ. of Cambridge), and William Symes (Rice Univ.).

The event was supported in part by CASPER and the Office of the Vice Provost for Research.



CASPER offers its first courses

During the spring and fall of 2011, CASPER offered its first two stand-alone courses taught solely by CASPER faculty. Both courses were offered by CASPER in conjunction with Baylor's Department of Physics.

Physics 3350: Topics in Astronomy

The course introduced students to contemporary topics in astronomy and astrophysics, particularly those currently under study at CASPER. As part of this course, tutorial sessions provided insight into topics such as protostellar formation, accretion disks, dust grain coagulation, the Oort cloud and Kuiper belt, exoplanets, accretion disks, galaxy formation, space missions, earth based astronomy and more.

Course sessions were taught by Dick Campbell, Gerald Cleaver, Truell Hyde, Victor Land, René Laufer, Lorin Matthews, Dwight Russell and Anzhong Wang.

Physics 5180: Topics in Space Missions

This course is the first offered by CASPER with a significant teaching contribution coming through its international faculty. The course introduced students to cutting-edge topics in near Earth and deep space science flight missions including launch vehicles and propulsion systems, interplanetary trajectories, the protection of materials and structures from the space environment, in-situ dust instrumentation, in-situ plasma instrumentation and remote sensing. Particular attention was given to areas under study by CASPER and instruments built within the center.

Topics covered both the physics behind the CASPER science instruments being flown on space missions and the engineering design of the spacecraft itself. Course sessions were

taught by CASPER faculty René Laufer, George Herdrich (CASPER/ IRS, University of Stuttgart), Truell Hyde, Jay Kong, Rainer Sandau (CASPER/IAA Paris/DLR Berlin), Ralf Srama (CASPER/IRS, University of Stuttgart/Max Planck Heidelberg) and Trey Cade (CASPER faculty and new director of the Baylor Institute for Air Science, BIAS).

CASPER Senior Design Project

During the fall of 2011 and spring of 2012, CASPER led its first senior design project offered in conjunction with the Baylor School of Engineering & Computer Science. The ECS students worked in CASPER's Space Science Lab (SSL) to develop an in-situ dust detector science flight instrument for the upcoming Attitude Related Maneuvers and Debris Instrument in Low Orbit (ARMADILLO) mission.

ARMADILLO was recently selected for flight in competition through the University Nanosatellite Program and is being built and flown in collaboration with the University of Texas at Austin's TEXAS Satellite Design Laboratory. Glen Lightsey (the Director of the TEXAS Satellite Design lab) holds primary responsibility for spacecraft development and CASPER faculty Truell Hyde, René Laufer and Ralf Srama (CASPER/IRS, University of Stuttgart/Max Planck Heidelberg) are responsible for the science instrument. The entire project will be built by UT Austin and Baylor students with an anticipated launch date in 2014. Stay tuned for updates on this upcoming flight mission!

HONORS AND AWARDS

CASPER adjunct faculty receives Tsiolkovsky Medal

The Russian Cosmonautics Federation recently awarded the K. E. Tsiolkovsky Medal to CASPER Adjunct Professor Dr. Rainer Sandau.

The award recognizes Dr. Sandau's achievements in space research, particularly his contributions to international space-based disaster monitoring systems.

Past recipients of the Tsiolkovsky Medal include well-known scientists and engineers, e.g. astronomer and author Carl Sagan.



CASPER research faculty becomes full member of IAA

At a special ceremony during the International Astronautical Congress in Cape Town, South Africa, CASPER research faculty Dr. René Laufer was elected full member for life of the International Academy of Astronautics (IAA).

Dr. Laufer currently serves as a member in the commission on space system operation and utilization and co-chairs the permanent committee on small satellite missions.

The IAA has more than 1200 members in 75 countries who are recognized by their peers for their contribution to astronautics and space exploration.

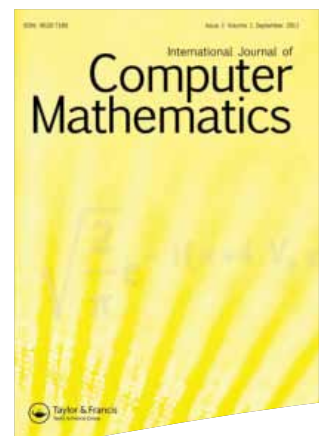


CASPER faculty member appointed editor-in-chief of international journal

Dr. Qin (Tim) Sheng was recently appointed editor-in-chief for the International Journal of Computer Mathematics' section on computational mathematics and applications.

The journal serves researchers in numerical analysis and scientific computing from both the academy and industry. It publishes original research with significant applications to sciences and engineering.

It covers topics including issues in multiscale modeling, quantum computation, uncertainty quantification, stochastic differential equations, novel applications in modern industries and highly effective algorithms for computational finance and systems biology.



SELECTED CASPER SEMINARS



Dr. Romualdo deSouza - Indiana University, Bloomington

A Hundred Meters Down and Light Years Away: Nuclear Science in an Extreme Laboratory

Dr. deSouza discussed an experimental approach to measuring the fusion excitation function for neutron-rich light nuclei, with the goal of identifying the energy source responsible for recently observed 'super-burster' X-ray bursts in binary star systems.



Dr. David Lary - University of Texas at Dallas

Multi-Scale Integrated Intelligent Interactive Sensing

More than ever, there is a need to close the gap between the satellite, airborne and terrestrial observations. To make best use of these improvements requires a comprehensive treatment of observation representativeness, calibration and validation. Ultimately, merging remote sensing observations on all scales is key to fully exploit the synergies and overcome the limitations of individual sensing techniques.



Dr. Marlan Scully - Texas A&M, Princeton, Baylor

Quantum Science and Engineering: "Ghost Lasers in the Sky"

In the wake of the post-9/11 anthrax attacks, Dr. Scully led a joint Texas A&M-Princeton team in developing a technique to instantly detect anthrax spores in the mail using lasers. His current research — dubbed "Ghost Lasers in the Sky" — applies knowledge from that project to the goal of developing a laser system capable of detecting threats in the upper atmosphere, from poison gas to pollutants, without ever leaving the ground.



Dr. Ralf Srama - University of Stuttgart, Max Planck Institute, Baylor

In-Situ Dust Instrumentation

Dr. Srama discussed basic instrument principles like charge induction, impact ionisation, depolarization and time-of-flight mass spectrometry. Dr. Srama is a CASPER adjunct associate professor and a senior scientist at the Max Planck Institute for Nuclear Physics in Heidelberg, Germany. He has five NASA awards for his contributions to Cassini-Huygens, a spacecraft mission studying the planet Saturn.



Dr. Zhimin Zhang - Wayne State University

High-Accuracy Eigenvalue Approximations by the Finite Element Method

Dr. Zhang discussed finite element approximations for the eigenvalue problem of the Laplace operator. A gradient recovery scheme is proposed to enhance the finite element solutions of the eigenvalues. By reconstructing the numerical solution and its gradient, it is possible to produce more accurate numerical eigenvalues. Furthermore, the recovered gradient can be used to form an *a posteriori* error estimator to guide an adaptive mesh refinement. Therefore, this method works not only for structured meshes, but also for unstructured and adaptive meshes.

Dr. Zhang is a visiting CASPER adjunct faculty member.

NEW CASPER MEMBERS



Dr. William "Trey" Cade

Dr. Cade recently joined CASPER as a CASPER fellow. Dr. Cade is the director of the Institute for Air Science and holds the Ph.D. in physics from Utah State University. He comes to Baylor from the U.S. Air Force and his primary research interests lie in the study of geomagnetic storms, auroral substorm processes and the end-to-end system of solar heliosphere-magnetosphere-ionosphere coupling.



Dr. Antonino Flachi

Dr. Flachi was recently hired as a CASPER assistant research scientist at Baylor. Dr. Flachi earned his Ph.D. in physics at the University of Newcastle upon Tyne. He comes to Baylor from the Yukawa Institute for Theoretical Physics in Kyoto, Japan. Dr. Flachi's research is focused on integration of cosmology, particle physics, string physics, and mathematical physics.



Dr. Rainer Sandau

Dr. Sandau is a CASPER adjunct professor and chief scientist at the German Aerospace Center (DLR) in Berlin. Dr. Sandau received his Ph.D. and later his habilitation in Cosmo-/Geosciences from the Academy of Sciences. He has been involved in space missions for over 30 years and has collaborated on projects with space agencies on four continents. Among many other international affiliations, Dr. Sandau is technical director of the International Academy of Astronautics and advisory committee chair of the International Society of Photogrammetry and Remote Sensing.



Dr. Jianxin Lu - University of Science and Technology of China

Dr. Lu is a visiting CASPER adjunct faculty member. He has conducted pioneering work and research in the so-called second superstring revolution and published more than 50 papers. Among other honors, he has been selected into the Program for Introducing Foreign Outstanding Talent by the Chinese Academy of Sciences and was named to the Cheung Kong Scholars Program by the Chinese Ministry of Education.

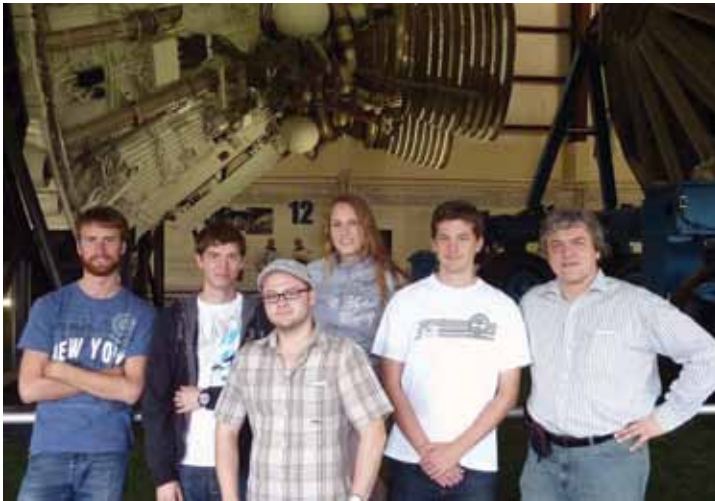
RESEARCH UPDATES

CASPER alum appears on History Channel program

Dr. Richard Obousy, who received his Ph.D. in physics at Baylor in 2008, recently appeared on the History Channel program "The Universe."

Dr. Obousy discussed interstellar propulsion concepts and his activities on Project Icarus, a volunteer theoretical engineering study to design an interstellar spacecraft.

Stuttgart graduate students on exchange at CASPER



From left to right: M. Dropmann, A. Wolf, H. Koch, S. Peters, C. Gomringer, R. Laufer in front of the Saturn V rocket at the NASA Johnson Space Center

As part of the collaboration with the Institute of Space Systems of the University of Stuttgart, Germany, graduate students of the School of Aerospace Engineering are now in residence at CASPER for approximately six months to carry out the research needed for their final theses.

Projects cover various topics which are being conducted within the collaborative research environment fostered between CASPER and

the Institute of Space Systems. The students are supervised by Dr. René Laufer, head of CASPER's Space Science Lab, and Dr. Truell Hyde, director of CASPER. Each of the students works in the lab, aided by Jorge Carmona-Reyes, Michael Cook and Jimmy Schmoke.

Recent research efforts include: Susanne Peters employing CASPER's light gas gun system to investigate hyper-velocity impacts on carbon nanotubes and Michael Dropmann conducting both numerical and experimental investigations into CASPER's new inductively heated plasma generator (IPG). Both Michael and Susanne presented their results as part of a special CASPER seminar series in late 2011 and have now returned to Germany where they defended their respective theses in early 2012.

Current research includes Christoph Gomringer's work on the design, development and assembly of an additional sidearm system connected to the IPG in order to provide low density plasma environments for detailed space environmental investigations. Helmut Koch is working on extending the initial diagnostics of the plasma generator to begin characterization of the facility.

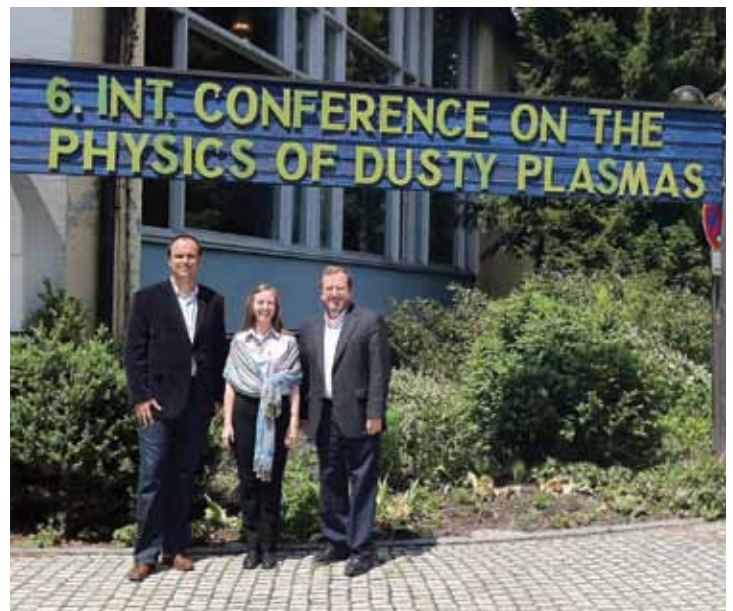
Finally, as part of the joint dust particle detector instrument development effort at CASPER and Stuttgart, Alexander Wolf is working on the Piezo Dust Detector, a miniaturized sensor system for dust and space debris investigations scheduled to be flown on the ARMADILLO nano satellite under construction at the University of Texas at Austin.

CASPER members give invited talks at 6th International Conference on the Physics of Dusty Plasmas

Drs. Truell Hyde, Lorin Matthews and Victor Land attended the 6th International Conference on the Physics of Dusty Plasmas, held in Garmisch, Germany in May 2011.

Dr. Hyde chaired one of the conference sessions while both Dr. Matthews and Dr. Land presented invited talks on the group's research. Dr. Matthews' talk, *Agglomeration of Dust Particles in Plasma*, highlighted recent experimental results on dust coagulation from CASPER's HIDPL. Dr. Land's presentation, *Numerical Simulations of Dusty Plasma*, highlighted recent numerical modeling results conducted within CASPER's ASSTG.

CASPER members contributing to the talks and an additional presented poster, *Dust Coagulation in Plasma Environments*, included Angela Douglass, Truell Hyde, Victor Land, Lorin Matthews, Jonathan Perry, Qianyu Ma, Ke Qiao, Jorge Carmona, Erwin Gostomski, and Douglas Coleman.





2011 NSF REU/ RET Fellows

Top Row:

Will Hicks Randall Dunkin
Brandon Doyle Brian Lopas

Row Below Top:

Dylan Losey Kevin Bombardier
Will Barnes Mark Sullivan

Row Above Bottom:

Lesley Vestal Katherine Boedges
Eric Van Oeveren Joseph Rauch

Bottom Row:

Audrey Burkart Erin Middlemas
Autumn Paro Kristen Deline

High School Scholar:

Jesse Kimery (not pictured)

REU and RET Programs

Sponsored by the National Science Foundation, CASPER, the Department of Physics and the School of Engineering & Computer Science

Once again CASPER, the Baylor Department of Physics and the School of Engineering & Computer Science hosted the NSF REU (Research Experience for Undergraduates) and RET (Research Experience for Teachers) programs. This year fourteen undergraduate students and two high school teachers participated in the program.

Theoretical and experimental research projects were conducted under the direction of Mr. Dick Campbell, Dr. Gerald Cleaver, Dr. Jay Dittmann, Dr. Truell Hyde, Dr. Victor Land, Dr. René Laufer, Dr. Lorin Matthews, Dr. Ke Qiao, and Dr. Dwight Russell. One high school student, Jesse Kimery, also participated in summer research through the High School Summer Science Research Program sponsored by Baylor's College of Arts and Sciences.

Students, teachers, faculty, and graduate students participating in this year's CASPER Summers Program attended weekly Wednesday Lunch Bunch Seminars and Friday Updates, enticed by the prospect of free food.

At the Wednesday seminars, CASPER faculty presented short talks on various topics including representing physics by sound, orbits, planning for small satellite and moon missions, rainbows and other optical phenomena. The students were also given tips on literature searches, writing papers, use LaTeX, preparing posters and slide shows, and applying to graduate school.

On Fridays, REU and RET fellows provided updates on their research experience to Drs. Hyde and Matthews and shared examples of their culinary capabilities.

At the end of the program, each participant presented a ten-minute talk at a final research conference and produced both a research poster and paper detailing their summer's research results.

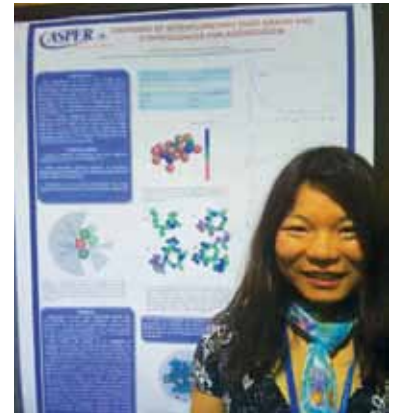
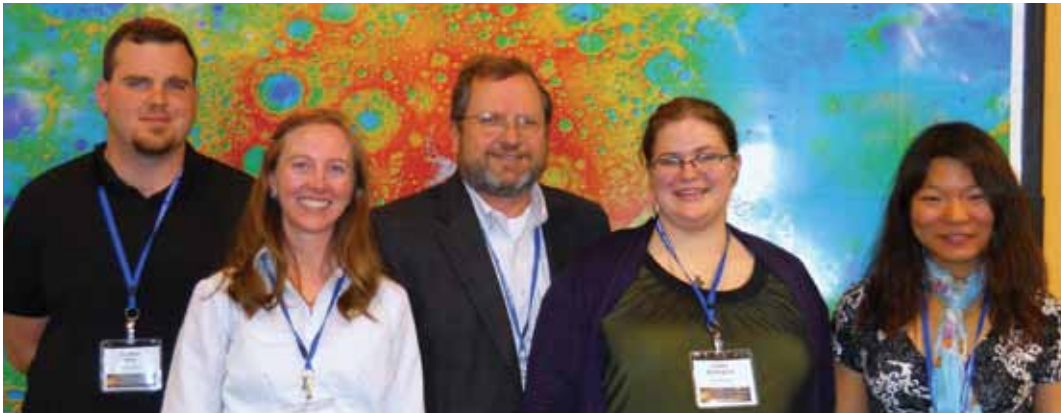
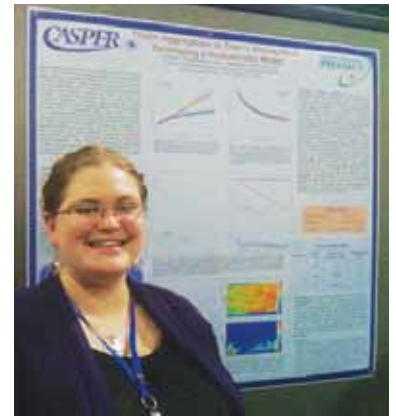
The ten-week program culminated with a dinner and awards presentation at The Palladium.

Lunar and Planetary Science Conference

Drs. Truell Hyde and Lorin Matthews, accompanied by graduate students Jonathan Perry and Theresa Ma and undergraduate Lindsay Buckingham attended the 42nd Lunar and Planetary Science Conference in The Woodlands, Texas, March 6-8, 2011.

Jonathan Perry gave a talk titled *The Influence of Monomer Shape on Aggregate Morphologies in First Stage Protoplanetary Development*; co-authors were Erwin Gostomski, Lorin Matthews, and Truell Hyde.

Theresa Ma and Lindsay Buckingham presented posters, *Charging of Interplanetary Dust Grains and Consequences for Aggregation* and *Tholin Aggregation in Titan's Atmosphere: Developing A Probabilistic Model*, respectively. Co-authors were Lorin Matthews and Truell Hyde.



Waco-area testing leads to historic space flight

SpaceX, a California-based aerospace company with testing facilities in McGregor, Texas, recently became the first commercial company to re-enter a spacecraft from Earth orbit. The company's Falcon 9 rocket, Merlin engines, and Dragon spacecraft were all tested at the SpaceX facility in McGregor, just outside of Waco.

The flight was the first of three planned demonstration flights of the Dragon spacecraft to demonstrate its capability to carry cargo to the International Space Station (ISS).

After the retirement of the Space Shuttle, SpaceX will fly at least 12 missions to carry cargo to and from the ISS as part of its Commercial Resupply Services contract for NASA.

The Dragon spacecraft's flight lasted just over three hours and represented the first spaceflight for a new, human-capable spacecraft since the launch of the Space Shuttle program more than thirty years ago.

The 180-foot Falcon 9 rocket is powered by a cluster of nine Merlin engines, generating more than one million pounds of thrust in the first stage. Just over three minutes after launch, the rocket separated and a single Merlin engine powered the Dragon spacecraft into its targeted orbit.

SpaceX works with a number of U.S. and international customers, including NASA, the Department of Defense, leading private aerospace companies, and international commercial and government entities.

Baylor students earn Texas Space Fellowships

CASPER undergraduate and graduate students have a long history of earning TxSpace Fellowships, and recent students have added to that success.

This year, Angela Douglass and Brandon Harris both earned TxSpace fellowships. In 2010, Douglass and Jared Greenwald received fellowships. Douglass, Harris and Greenwald are all doctoral candidates in physics.

In addition, CASPER student Michael Hughes was awarded a Columbia Crew Memorial Undergraduate Scholarship for 2011-2012. Michael is a junior at Baylor studying engineering and computer science.

The Texas Space Grant Consortium is a group of 47 government, industry, educational, and non-profit institutions in Texas that work to bring the benefits of space research and technology to all Texans. Baylor and CASPER participated in the original proposal establishing the NASA block grant.

CASPER delegation invited to opening of new space center at University of Stuttgart

A team of CASPER personnel was on hand in October for the opening of the new Space Center Baden-Wuerttemberg. The University of Stuttgart's Institute of Space Systems, CASPER's partner in research, and the German SOFIA Institute will call the new facility home. The 20,000 square-foot facility was dedicated in October after two years of construction.

New facilities at the center include laboratories for satellite integration, satellite simulation, infrared instrumentation, and superconducting materials. The center is also equipped with lecture halls and seminar rooms, as well as a three-story entrance hall for space-related events and exhibitions.

Alongside existing facilities like the large plasma labs, the new building strengthens the University of Stuttgart's position as Europe's largest academic center for space research, education and workforce development. Approximately 2,000 students pursue bachelor's, master's, and doctoral degrees at the School for Aerospace Engineering and Geodesy.

CASPER Director Dr. Truell Hyde spoke at the opening ceremony representing the institute's international partners together with NASA chief scientist Dr. Paul Hertz and EADS Astrium manager Dr. Eckard Settlemeyer. Baylor Advanced Research Institute program director Jim Kephart and CASPER research faculty member Dr. René Laufer rounded out the delegation to Stuttgart.

In addition to attending the opening ceremony, CASPER representatives participated in discussions and meetings with their Stuttgart counterparts regarding ongoing and future



planned research projects. They also undertook detailed inspections of the new Stuttgart building and facilities - an area of major interest in light of CASPER's own move in 2012 into its new home at the Baylor Research and Innovation Collaborative (BRIC).

At the request of Dr. Hans-Peter Röser, director of the institute, Dr. Truell Hyde also presented an invited lecture titled *Projects and Research at CASPER: Complex (Dusty) Plasma Physics* to the institute's faculty, staff and students.

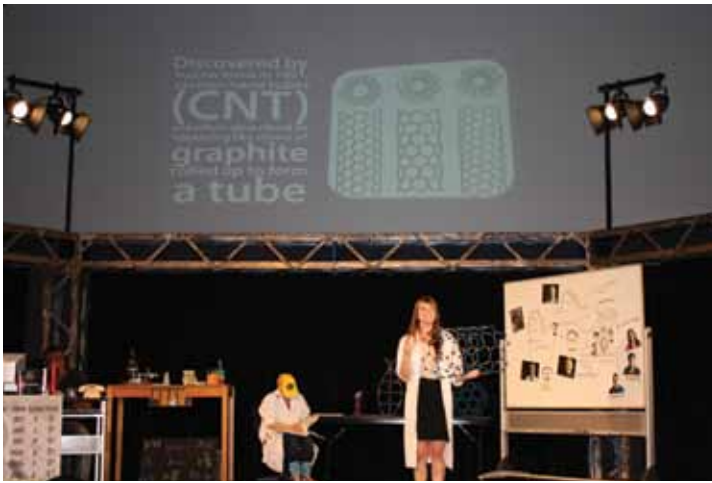


CASPER research scientist featured on German agency magazine cover

Dr. René Laufer was recently featured on the cover of a special issue of the DGLR magazine. The issue was focused on education and workforce development, and profiled a number of institutions including the International Space University.

Dr. Laufer, pictured on the right-hand side of the cover, said he only regrets that he was not wearing a shirt with CASPER insignia on the day he was photographed.

"I was wearing the NASA shirt because of a visitor to the lab," he said, "but if I had known I was going to be on the cover, I would have worn a CASPER shirt instead."



Physics Circus 2011: 'CASPER Science Investigators' - Using science to solve mysteries

The Physics Circus marked its 12th year with a 'CSI' theme - the CASPER Science Investigators. Over 2,000 10th and 11th grade students from the Waco and La Vega Independent School Districts acted as junior CASPER science investigators to help identify patterns and find clues in a multiple missing-persons case. As always, students were both entertained and educated through the comical theatrical performance that set the stage for solving the mystery in the Science Lab (Fun House).

Dr. Cyndi Hernandez, assistant director for educational research and outreach for CASPER, said that much planning went into making the presentation relevant for students in the GEAR UP Waco cohort.

"We integrated popular music with science and math content aligned with grade equivalent national and state standards," she said, "and then created videos starring each of the four schools' principals to enhance the experience."

13th workshop
on the physics of dusty plasma

SAVE THE DATE & JOIN US
for the 13th workshop on the physics of dusty plasma

When? May 20th - 23rd 2012
Where? Waco, Texas, USA
Details? www.baylor.edu/wpdp

During the event, students learned about the latest scientific findings in nanotechnology and applied their knowledge to identify the common thread that would link all the missing people.

With the aid of physicists at each booth in the Fun House, the students identified clues, analyzed variables and interpreted data. By uncovering clues embedded in the presentation and the Fun House displays, students learned about a number of physics concepts including carbon allotropes, space elevators, the Lotus effect, and the antibacterial properties and side effects of nanosilver materials.

The 2011 Physics Circus built on knowledge students had learned in previous years to present more comprehensive

material related to spectroscopy and its applications in nanotechnology. This year's event concluded the three-year journey from intergalactic scale through nanoscale. Along the way, students learned about the advantages of using scientific notation to represent different scales.

Two of the goals of the Physics Circus are to improve students' attitudes toward pursuing a STEM (science, technology, engineering and math) career and to prepare students academically for college.

In support of these goals, the 2012 Physics Circus will have an entirely new theme where the students will be confronted with one of our most critical current issues: finding a source of viable energy that will take us to the next level of development.

The study of solar, thermal, radiant and nuclear energy sources will help students achieve a deeper understanding of the physics involved in converting resources into energy that we can use in our homes and businesses.

The Physics Circus website has information on the 2012 Physics Circus, as well as new materials and resources for teachers, students, after-school clubs and home-schools.

There's also a link to the CASPER Space Place group on Facebook, and even an opportunity to get answers from a real scientist in the "Ask a Physicist" section.

Check it out at: <http://www.baylor.edu/physicscircus>.



Recent Publications

Submitted Papers / Articles to Print Journals & Books (2011)

- Algorithm for Determining $U(1)$ Charges in Free Fermionic Heterotic String Models*, W. Hicks, L. Vestal, J. Greenwald, D. Moore, T. Renner, and G. Cleaver, [arXiv:1108.4082], Submitted to Journal of Undergraduate Research in Physics.
- Analytic surgery of the zeta function*, K. Kirsten, P. Loya, to appear in Commun. Math. Phys.
- Charging of Interstellar Dust Grains Near the Heliopause*, Q. Ma, L. Matthews, V. Land and T. W. Hyde, Submitted for publication in Astrophysical Journal, 2011.
- Charging and Coagulation of Dust in Protoplanetary Plasma Environments*, L. Matthews, V. Land and T. W. Hyde, Submitted for publication in Astrophysical Journal, 2011.
- Eikonal decomposition methods for fast computations of beam propagations*, Q. Sheng, S. Guha and L. Gonzalez, Eng. Comput., in press, 2011.
- Experimental and Numerical Techniques to assess Catalysis*, G. Herdrich, M. Fertig, D. Petkow, A. Steinbeck, S. Fasoulas, submitted to Progress in Aerospace Sciences Special issue, 2011.
- General relativity limit of Horava-Lifshitz gravity with a scalareld in gradient expansion*, A.E. Gumrukcuoglu, S. Mukohyama, and A. Wang, submitted for publication.
- Ghosts and Stability of Asymptotical Safe Gravity in the Minkowski Background*, C. Gao and A. Wang, submitted for publication.
- Heat kernel coefficients for Laplace operators on the spherical suspension*, K. Kirsten, G. Fucci. To appear in Commun. Math. Phys.
- Initial Systematic Investigation of the Landscape of Low Layer NAHE-Variation Extensions*, by T. Renner, J. Greenwald, D. Moore, and G. Cleaver. [arXiv:1111.1917], Submitted to Nuclear Physics B.
- Initial Systematic Investigation of the Landscape of Low Layer NAHE Extensions*, by T. Renner, J. Greenwald, D. Moore, and G. Cleaver. [arXiv:1111.1263], Submitted to Nuclear Physics B.
- Mode Coupling and Conversion of a Horizontal Dust Pair in a Complex Plasma*, K. Qiao, T. W. Hyde, L.S. Matthews, J. Kong and V. Zhang, Submitted to New Journal of Physics, 2011.
- SARIM PLUS - Sample Return of Comet 67P/CG and of Interstellar Matter*, R. Srama, H. Krüger, T. Yamaguchi, T. Stephan, M. Burchell, A. Kearsley, M. Khan, V. Sterken, F. Postberg, M. Landgraf, S. Kempf, E. Grün, N. Altobelli, P. Ehrenfreund, V. Dikarev, M. Horanyi, Z. Sternovsky, J. Carpenter, L. Colangeli, A. Westphal, P. Tsou, A. Krabbe, J. Agarwal, U. Auster, H. Yano, J. Blum, H. Henkel, J. Hillier, P. Hoppe, M. Trieloff, S. Green, S. Hsu, A. Mocker, K. Fiege, S. Green, F. Esposito, R. Laufer, T. W. Hyde, G. Herdrich, S. Fasoulas, A. Jäckel, G. Jones, E. Khalisi, G. Moragas-Klostermeyer, F. Spahn, H. U. Keller, A. Krivov, A. C. Levasseur-Regourd, N. Pailer, K. Altwegg, C. Engrand, S. Auer, V. Della Corte, S. Sasaki, M. Kobayashi, J. Schmidt, J. Kissel, B. Marty, J.-C. Liou, T. Shahverdyan, H. P. Röser, submitted to Experimental Astronomy, 2011.
- The Influence of Monomer Shape on Aggregate Morphologies*, J.D. Perry, E. Gostomski, L. S. Matthews and T. W. Hyde, Submitted to Astrophysical Journal, 2011.

Published Papers / Articles in Print Journals & Books (2011)

- An exponential transformation based splitting method for fast computations of highly oscillatory solutions*, Q. Sheng, S. Guha and L. Gonzalez, J. Comp. Appl. Math., 235, 4452-4463, 2011.
- Agglomeration of Dust Particles in Plasma*, L. S. Matthews, T. W. Hyde, V. Land, Q. Ma and J. Perry, Proceedings of the 6th International Conference on the Physics of Dusty Plasmas, Garmisch-Partenkirchen, 2011.
- Agglomeration of Dust Particles in the Lab*, L. Matthews, J. C. Reyes, V. Land and T. W. Hyde, AIP Conference Proceedings, 2011.
- ARMADILLO – A Demonstration for a Cis-Lunar Exploration Mission of the Kordylewski Clouds*, R. Laufer, T. W. Hyde, Proceedings of the 62nd International Astronautical Congress, Prague, Cape Town, South Africa, 2011.
- Assessment of a numerical approach suitable for the M2P2 problem*, M. Pfeiffer, D. Petkow, G. Herdrich, S. Fasoulas, The Open Journal of Plasma Physics, Volume 4, pp. 24-33, April 2011.
- Atmospheric Entry Simulation Capabilities of the IRS Plasma Wind Tunnel PWK3 for Mars and Venus*, G. Herdrich, M. Dropmann, Th. Marynowski, S. Fasoulas, reviewed and accepted by the Applied Physics Research, July 2011.
- Black holes and global structures of spherical spacetimes in Horava-Lifshitz theory*, J. Greenwald, J. Lenells, J. X. Lu, V. H. Satheeshkumar, and A. Wang, Phys. Rev., D84, 084040 (25 pages) (2011) [arXiv:1105.4259].
- Bose-Einstein condensation on product manifolds*, K. Kirsten, G. Fucci, J. Phys. A: Math. Theor. 44, 332002 (8pp), 2011.

- Casimir Energy and Brane Stability*, Jour. Geometry and Physics 61 (2011) 577, by R. Obousy and G. Cleaver. [arXiv:0810.1096]
- Conical Casimir pistons with hybrid boundary conditions*, K. Kirsten, G. Fucci, J. Phys. A: Math. Theor. 44, 295403, 2011.
- Cosmology in nonrelativistic general covariant theory of gravity*, A. Wang and Y. Wu, Phys. Rev. D 83, 044031 (8 pages), 2011.
- Detailed balance condition and ultraviolet stability of scalar field in Horava-Lifshitz gravity*, A. Borzou, K. Lin, and A. Wang, JCAP, 1105, 006 (21 pages), 2011.
- Dust Coagulation in Plasma Environment*, J.D. Perry, Q. Ma, V. Land, J. C.-Reyes, L.S. Matthews and T. W. Hyde, Proceedings of the 6th International Conference on the Physics of Dusty Plasmas, Garmisch-Partenkirchen, 2011.
- Dust Particle Charge in Plasma with Ion Flow and Electron Depletion*, A. Douglass, V. Land, L. Matthews and T. W. Hyde, Accepted for publication in Physics of Plasmas, 2011.
- Experimental study of the asymmetric charge transfer reaction between Ar⁺ ions and Fe atoms*, I. Korolov, G. Bánó, Z. Donkó, A. A. Derzsind, and P. Hartmann. J. Chem. Phys., 134, 064308; IF: 3.093, 2011.
- f(R) theory and geometric origin of the dark sector in Horava-Lifshitz gravity*, A. Wang, Mod. Phys. Lett. A 26, 387-398, 2011.
- First Principles and the Standard Model*, M. Robinson, K. Bland, G. Cleaver, J. Dittmann, and M. Serna, (Springer, New York, 2011).
- Ground-state structures of superparamagnetic two-dimensional dusty plasma crystals*, P. Hartmann, M. Rosenberg, G. J. Kalman and Z. Donkó, Phys. Rev. E, 84, 016409, IF: 2.352, 2011.
- Growth of heat trace and heat content asymptotic coefficients*, K. Kirsten, M. van den Berg and P. Gilkey, submitted to J. Funct. Anal. 261, 2293-2322, 2011.
- Habilitation: Raumfahrtrelevante Plasmen und deren anwendungsbezogene Klassifizierung*, Institut für Raumfahrtsysteme, G. Herdrich, Universität Stuttgart, submitted June 2011.
- Investigations of Quasi-Realistic Heterotic String Models with reduced Higgs Spectrum*, G. Cleaver, A. Faraggi, J. Greenwald, D. Moore, K. Pechan, E. Remkus, and T. Renner, European Physical Journal C 71 (2011) 1842.
- Modeling Agglomeration of Dust Particles in Plasma*, L. Matthews, V. Land, Q. Ma, J. Perry and T. W. Hyde, AIP Conference Proceedings, 2011
- Note on a NAHE Variation*, J. Greenwald, K. Pechan, T. Renner, T. Ali, and G. Cleaver, Nuclear Physics, B850, pp. 445-462, 2011.
- Numerical Simulations of Dusty Plasma*, V. Land, L.S. Matthews, T. W. Hyde and W.J. Goedheer, Proceedings of the 6th International Conference on the Physics of Dusty Plasmas, Garmisch-Partenkirchen, 2011.
- On strong coupling in nonrelativistic general covariant theory of gravity*, K. Lin, A. Wang, Q. Wu, and T. Zhu, Phys. Rev. D 84, 044051 (8 pages), 2011.
- One-Dimensional Vertical Dust Strings in a Glass Box*, J. Kong, T. W. Hyde, L. Matthews, K. Qiao, Z. Zhang and A. Douglass, Physical Review E, 84, 016411, 2011.
- Parameter Study for Configuration and Input Flow Conditions of Low Electric Power Segmented Arc Heaters*, J. I. Lee, G. Herdrich, K. H. Kim, AIAA Journal, February 2011.
- Pistons modeled by potentials*, G. Fucci, P. Morales and K. Kirsten, Springer Proceedings in Physics, Vol. 137, "Cosmology, Quantum Vacuum, and Zeta Functions", Edited by S. Odintsov, D. Sáez-Gómez and S. Xambó, Springer Verlag, Berlin, pp. 313 - 322, 2011.
- Radiating gravastars*, R. Chan, M.F.A. da Silva, Jaime F. Villas da Rocha, and A. Wang, JCAP, 10, 013 (18 pages) (2011) [arXiv:1109.2062].
- Redundancies in Explicitly Constructed Ten Dimensional Heterotic String Models*, T. Renner, J. Greenwald, and D. Moore. Int'l J. of Mod. Physics A 26 (2011) 4451, [arXiv:1107.3138]
- Spacetime Singularities in String and its Low Dimensional Elective Theory*, P. Sharma, A. Tziolas, A. Wang, and Z.-C. Wu, Int'l J. of Mod. Physics A 26, 273-300, 2011.
- Stability, ghost, and strong coupling in nonrelativistic general covariant theory of gravity with $\epsilon = 1$* , Y. Huang and A. Wang, Phys. Rev. D 83, 104012 (11 pages), 2011.
- Stability of spin-0 graviton and strong coupling in Horava-Lifshitz theory of gravity*, A. Wang and Q. Wu, Phys. Rev. D 83, 044025 (13 pages), 2011.
- Static and dynamic shear viscosity of a single-layer complex plasma*, P. Hartmann, M. Sándor, A. Kovács, Z. Donkó; Phys. Rev. E, 84, 016404; IF: 2.352, 2011.
- Systematic Investigations of the Free Fermionic Heterotic String Gauge Group Statistics: Layer One Results*, 2411, D. Moore, J. Greenwald, T. Renner, M. Robinson, C. Buescher, M. Janas, G. Miller, and S. Ruhnau. Mod. Physics Letters A 26 (2011) [arXiv:1107.5758].
- The Effect of Dust Charge Variation, Due to Ion Flow and Electron Depletion, on Dust Levitation*, V. Land, A. Douglass, K. Qiao, L. Matthews, T. W. Hyde, AIP Conference Proceedings, 2011.

The Effect of Electrode Heating on the Discharge Parameters in Complex Plasma Experiments, V. Land, J. Alberto C. Reyes, J. Creel, J. Schmoke, M. Cook, L. Matthews and T. W. Hyde, Plasma Science Sources and Technology, Vol. 20, No. 1, 2011.

The Casimir effect for conical pistons, K. Kirsten, G. Fucci, JHEP 03, 016 (30 pp), 2011.

The Influence of Monomer Shape on Aggregate Morphologies in First Stage Protoplanetary Development, J. Perry, E. Gostomski, L.S. Matthews and T. Hyde, Lunar and Planetary Science XXXXII, Lunar and Planetary Science Conference, Houston (CD-ROM), 2011.

Books in Press (2011):

High Resolution Optical Satellite Imagery, I. Dowman, K. Jacobsen, G. Konecny, R. Sandau: Whittles Publishing, ISBN 978-184995-046-6, 256 pp, in press, 2011.

Presentations (2011):

A New Inductively Driven Plasma Generator (IPG) Source, T. Hyde, R. Laufer, G. Herdrich, M. Dropmann, S. Peters, L. Matthews, M. Cook, J. Schmoke, paper presented at the 53rd Annual Meeting of the APS Division of Plasma Physics, Salt Lake City, Utah, November 14-18, 2011.

A Stability Concern in Adaptive-Splitting for Quenching Solutions of Singular Reaction-Diffusion Equations, T. Sheng, Invited colloquium talk, Univ. of Macau, June 8, 2011.

An Evolution of the Splitting from Cosine to Eikonal Schemes, T. Sheng, Invited colloquium talk, Southeast Univ., June 22, 2011.

Anisotropic scalings and a theory of quantum gravity, A. Wang, Annual Meeting of Chinese Gravitational Physics and Astrophysics, Datong, Shanxi, China, August 15-19, 2011.

Anisotropic scalings and a theory of quantum gravity, A. Wang, IPMU, University of Tokyo, Kashiwa, Japan, July 6, 2011.

Anisotropic scalings and Horava-Lifshitz theory of quantum gravity: An updated review, A. Wang, College of Sciences, University of Science and Technology of China, June 15, 2011.

Agglomeration of Dust Particles (Invited Talk), L.S. Matthews, T. W. Hyde, V. Land, Q. Ma and J. Perry, 6th Int'l Conference on the Physics of Dusty Plasmas, Garmisch-Partenkirchen, 2011.

Charging of Interplanetary Dust Grains and Consequences for Aggregation, Q. Ma, L. S. Matthews and T. W. Hyde, poster presented at the 42nd Lunar and Planetary Institute, The Woodlands, Texas, March 7-11, 2011.

Coagulation of Dust Particles in Plasma, L. Matthews, poster presented at the 23rd Annual Kavli Frontiers of Science Symposium, Irvine, CA, November 17-19, 2011.

Tholin Aggregation in Titan's Atmosphere: Developing a Probabilistic Model, L.K. Buckingham, L.S. Matthews and T. W. Hyde, Lunar and Planetary Science XXXXII, Lunar and Planetary Science Conference, Houston (CD-ROM), 2011.

U(1) symmetry and elimination of spin-0 gravitons in Horava-Lifshitz gravity without the projectability condition, T. Zhu, Q. Wu, A. Wang, and F.-W. Shu, Phys. Rev. D84, 101502 (Rapid Communications) (5 pages) (2011) [arXiv:1108.1237].

Vector and tensor perturbations in Horava-Lifshitz cosmology, A. Wang, Phys. Rev. D82, 124063 (9 pages), 2010.

Zeta functions of quantum graphs, K. Kirsten and J.M. Harrison, J. Phys. A: Math. Theor. 44, 235301 (29pp), 2011.

Symmetry and the Standard Model, M. Robinson, K. Bland, G. Cleaver, J. Dittmann, and M. Serna: Springer, in press.

Collective modes in mass-asymmetric bilayers, K. I. Golden, G. J. Kalman, P. Hartmann, pp. 121 in: Book of Abstracts of the Strongly Coupled Coulomb Systems conference (ISBN 978-963-88019-5-1), Budapest, Hungary, July 24-29, 2011.

Colliding Rice Grains in Space, J. D. Perry, E. Gostomski, L. S. Matthews and T. W. Hyde, presented at Lunar and Planetary Science XXXXII, Lunar and Planetary Science Conference, Houston, 2011.

Complex viscosity of 3D Yukawa liquids, Z. Donkó, J. Goree, and P. Hartmann, pp. 123 in: Book of Abstracts of the 6th International Conference on the Physics of Dusty Plasmas, Garmisch-Partenkirchen, Germany, May 16-20, 2011.

Cosmic dust bunnies and laboratory dust crystals: An introduction to complex plasma research, L. Matthews, seminar presented to the Departments of Physics and Electrical Engineering and the UTD chapter of Sigma Xi, February 11, 2011.

Cosmology in Horava-Lifshitz theory of quantum gravity, A. Wang, presented to Physics Department, UT Dallas, Texas, USA, November 11, 2011.

Crystallization dynamics of a 2D Yukawa systems, A. Kovács, P. Hartmann, Z. Donkó, I Groma, and G. Györgyi, pp. 259 in: Book of Abstracts of the 6th International Conference on the Physics of Dusty Plasmas, Garmisch-Partenkirchen, Germany, May 16-20, 2011.

Dust Coagulation in Plasma Environments, J.D. Perry, Q. Ma, V. Land, J. Carmona-Reyes, L. S. Matthews and T. W. Hyde, 6th International Conference on the Physics of Dusty Plasmas, Garmisch-Partenkirchen, 2011.

- Dust Particle Charge in Complex Plasma Experiment*, A. Douglass, V. Land, K. Qiao, L. Matthews, and T. Hyde, paper presented at the 53rd Annual Meeting of the APS Division of Plasma Physics, Salt Lake City, Utah, November 14-18, 2011.
- Dynamics shear viscosity in a 2D Yukawa system*, A. Kovács, P. Hartmann, and Z. Donkó, pp. 138 in: Book of Abstracts of the Strongly Coupled Coulomb Systems conference (ISBN 978-963-88019-5-1), Budapest, Hungary, July 24-29, 2011.
- Effects of dust on the optical emission and electrical properties in a dusty plasma experiment*, V. Land, A. Paro, E. Middlemas, J. Carmona-Reyes, A. Douglass, L. Matthews, T. Hyde, presented at the 53rd Annual Meeting of the APS Division of Plasma Physics, Salt Lake City, Utah, November 14-18, 2011.
- Employing a Zyvex S100 Nanomanipulator Within a Complex Plasma*, B. Harris, L. Matthews, and T. Hyde, paper presented at the 53rd Annual Meeting of the APS Division of Plasma Physics, Salt Lake City, Utah, November 14-18, 2011.
- From Exponential, Adaptive, Cosine to Eikonal Splitting: A Challenge Forever*, T. Sheng, Invited colloquium talk, Nanjing Univ, June 17, 2011.
- Ground state structures of superparamagnetic dusty plasma crystals*, P. Hartmann, M. Rosenberg, G. J. Kalman, and Z. Donkó, pp. 124 in: Book of Abstracts of the Strongly Coupled Coulomb Systems Conf. (ISBN 978-963-88019-5-1), Budapest, Hungary, July, 2011.
- Horava's theory of quantum gravity*, A. Wang, presented to Physics Department, UT Arlington, Texas, USA, October 26, 2011.
- Horava-Lifshitz Theory: An updated review*, A. Wang, presented at The Advanced Theoretical Physics Conference on the Origin and Nature of Dark Energy, Tunxi, Anhui, China, April 7-18, 2011.
- Influence of Monomer Shape on Aggregates*, J. Perry, K. Bombardier, L. Matthews, T. Hyde, poster presented at the 53rd Annual Meeting of the APS Division of Plasma Physics, Salt Lake City, Utah, November 14-18, 2011.
- Interaction of Charged Aggregates in a GEC rf Reference Cell*, K. Deline, B. Doyle, J. Carmona-Reyes, L. Matthews, T. Hyde, poster presented at the 53rd Annual Meeting of the APS Division of Plasma Physics, Salt Lake City, Utah, November 14-18, 2011.
- Is Two Better Than One? An Adaptive-Splitting Exploration into the Quenching Solution of Singular Reaction-Diffusion Equations on Nonuniform Grids*, T. Sheng, Invited colloquium talk, Hong Kong Baptist Univ, June 3, 2011.
- ISPRS - Structure and future focus areas*, R. Sandau, 48th STC Meeting UN COPUOS, Vienna, Austria, February 6-12, 2011.
- ISPRS' climate change monitoring activities*, R. Sandau, ESPI/EA/ISPRS conference on "Remote Sensing Regional Climate Change", Vienna, Austria, May 27-28, 2011.
- Magnetized strongly coupled plasmas - first principle results*, T. Ott, M. Bonitz, P. Hartmann, and Z. Donkó, pp. 42 in: Book of Abstracts of the Strongly Coupled Coulomb Systems conference (ISBN 978-963-88019-5-1), Budapest, Hungary, July 24-29, 2011.
- Molecular dynamics simulation of moderately coupled Yukawa liquids on graphics processor units*, Á. Budea, A. Derzsi, P. Hartmann, and Z. Donkó; pp. 135 in: Book of Abstracts of the Strongly Coupled Coulomb Systems conference (ISBN 978-963-88019-5-1), Budapest, Hungary, July 24-29, 2011.
- Normal Modes and Mode Coupling in a Dust Cluster*, K. Qiao, J. Kong, Z. Zhang, L. Matthews, T. Hyde, paper presented at the 53rd Annual Meeting of the APS Division of Plasma Physics, Salt Lake City, Utah, November 14-18, 2011.
- Numerical Simulations of Dusty Plasma (Invited Talk)*, V. Land, L. S. Matthews, T. W. Hyde and W. J. Goedheer, 6th International Conference on the Physics of Dusty Plasmas, Garmisch-Partenkirchen, 2011.
- Phase Transitions in a Capacitively Coupled Dusty Plasma with Conducting Dust*, J. Carmona-Reyes, L. Matthews, T. Hyde, poster presented at the 53rd Annual Meeting of the APS Division of Plasma Physics, Salt Lake City, Utah, November 14-18, 2011.
- Remote Sensing and Earth Observation - Status and Trends of Small Satellite Missions*, R. Sandau, 1st IAA Conference on University Satellite Missions, Rome, Italy, January 25-29, 2011.
- Small satellites for Earth observation - Status quo and summary of recent IAA Symposium in Berlin*, R. Sandau, ISPRS Hannover Workshop 2011, High-Resolution Earth Imaging for Geospatial Information, Hannover, Germany, June 14-17, 2011.
- The 2011 CASPER GEAR UP Physics Circus Professional Development for High School Teachers*, C. Hernandez, T. Hyde, J. Carmona-Reyes, Mayborn Museum Complex, January 27, 2011.
- The Dust Temperature Distribution Within a Dust Density Wave Formed in a Complex Plasma*, Z. Zhang, K. Qiao, J. Kong, L. Matthews, and T. Hyde, paper presented at the 53rd Annual Meeting of the APS Division of Plasma Physics, Salt Lake City, Utah, November 14-18, 2011.
- The Influence of Monomer Shape on Aggregate Morphologies in First Stage Protoplanetary Development*, J. D. Perry, E. Gostomski, L. S. Matthews and T. W. Hyde, paper presented at the 42nd Lunar and Planetary Institute, The Woodlands, Texas, March 7-11, 2011.

The origin of the roton minimum, G. J. Kalman, S. Kyrkos, K. I. Golden, P. Hartmann, and Z. Donkó, pp. 89 in: Book of Abstracts of the Strongly Coupled Coulomb Systems conference (ISBN 978-963-88019-5-1), Budapest, Hungary, July 24-29, 2011.

Tholin Aggregation in Titan's Atmosphere: Developing A Probabilistic Model, L.K. Buckingham, L. S. Matthews, T. W. Hyde, poster presented at the 42nd Lunar and Planetary Institute, The Woodlands, Texas, March 7-11, 2011.

Using a One-Dimensional Dust String as an In-Situ Probe in a Complex Plasma, J. Kong, K. Qiao, B. Harris, A. Douglass,

Z. Zhang, L. Matthews, and T. Hyde, paper presented at the 53rd Annual Meeting of the APS Division of Plasma Physics, Salt Lake City, Utah, November 14-18, 2011.

Zeta functions everywhere, K. Kirsten, Baylor University, Waco, TX, USA, January 28, 2011.

Zeta functions everywhere, K. Kirsten, University of Texas at Austin, Austin, TX, USA, February 11, 2011.

Zeta functions on surfaces of revolution, K. Kirsten, AMS Spring Central Section Meeting, University of Iowa, Iowa City, IA, USA, March 18-20, 2011.

Published Papers / Articles in Print Journals & Books (2010)

Airborne Re-Entry Observation Experiment SLIT: UV Spectroscopy during STARDUST and ATV1 Re-Entry, S. Löhle, R. Wernitz, G. Herdrich, M. Fertig, H. P. Röser, H. Ritter, CEAS Space Journal, / DOI 10.1007/s12567-010-0005-3, September 2010.

Basic zeta functions and some applications in physics, K. Kirsten, A Window Into Zeta and Modular Physics, Mathematical Sciences Research Institute Publications, Volume 57, p. 101-143, 2010.

Charging of Interplanetary Dust Grains and Consequences for Aggregation, Q. Ma, L.S. Matthews and T. W. Hyde, Lunar and Planetary Science XXXII, Lunar and Planetary Science Conference, Houston (CD-ROM). 2010.

Correlational origin of the roton minimum, G. J. Kalman, P. Hartmann, K. I. Golden, A. Filinov, Z. Donkó, Europhysics Letters 90, 55002; IF: 2.893, 2010.

Current Status of Instrumentation Developments at IRS: In-Situ Investigations and Airborne Measurement Campaigns, G. Herdrich, M. Fertig, S. Lein, S. Löhle, A. Preci, A. Steinbeck, R. Wernitz, M. Auweter-Kurtz and H. P. Röser, Acta Astronautica 66, pp. 1087-1098, 2010.

Constraints on growth index parameters from current and future observations, J. Dossett, M. Ishak, J. Moldenhauer, Y.-G. Gong, and A. Wang, JCAP, 04, 022, 2010.

Dynamics of two-dimensional dipole systems, K. I. Golden, G. J. Kalman, P. Hartmann, Z. Donkó, Phys. Rev. E; 82, 036402/1-12; IF: 2.352, 2010.

Effect of Capacitance on Discharge Behavior of Pulsed Plasma Thruster, T. Schönherr, K. Komurasaki, R. Kawashima, Y. Arakawa, and G. Herdrich, Department of Advanced Energy, The University of Tokyo, Department of Aeronautics and Astronautics, The University of Tokyo, Institute of Space Systems (IRS), Universität Stuttgart, Journal of IAPS, Vol. 18, No. 1, pp. 23-28, June 2010.

Effect of Charged-Magnetic Grains in Protoplanetary Disks, J. Perry, L. Matthews, T. W. Hyde, Submitted to Adv. Space Res. Abstracts, COSPAR, Bremen, Germany (CD-ROM), 2010.

Electric Propulsion Systems for Small Satellites: The LEO Mission Perseus, D. Bock, G. Herdrich, M. Lau, T. Schönherr, B. Wollenhaupt and H. P. Röser, accepted for EUCASS, 2010

Establishing an Environmental Simulation Facility for Complex (Dusty) Space Plasma Research, R. Laufer, T. W. Hyde, L. Matthews, G. Herdrich, R. Srama, H. P. Röser, Submitted to Adv. Space Res. Abstracts, COSPAR, Bremen, Germany (CD-ROM), 2010.

Experimental Insights into Modeling of a Pulsed Plasma Thruster, P. Shaw, V. Lappas, A. Nawaz, M. Lau, and G. Herdrich, Journal of Propulsion and Power, January 2010.

Final Design and Performance Parameters of the Payloads PYREX, PHLUX and RESPECT on EXPERT, S. Lein, A. Steinbeck, A. Preci, M. Fertig, G. Herdrich, H. P. Röser, M. Auweter-Kurtz, Aerospace Technology Japan, Vol. 8, pp. Tm_41-Tm_47, 2010.

f(R) theory and geometric origin of the dark sector in Horava-Lifshitz gravity, A. Wang, Mod. Phys. Lett. A26, 387-398, 2011.

Functional determinants in higher dimensions using contour integrals, K. Kirsten, A Window Into Zeta and Modular Physics, Mathematical Sciences Research Institute Publications, Vol. 57, p. 307-328, 2010.

Growth of Fractal Aggregates Within a Protoplanetary Disk, L. Matthews, V. Land and T. W. Hyde, Submitted to Adv. Space Res. Abstracts, COSPAR, Bremen, Germany (CD-ROM), 2010.

Health Monitoring of TPS Structures by Measuring Their Electrical Resistance, A. Preci, G. Herdrich, A. Steinbeck, M. Auweter-Kurtz, Trans. JSASS Space Tech., Aerospace Tech. Japan, Vol. 8, pp. 29-34, 2010.

Measurements of Plasma Properties Using Fast Sweep Langmuir Probes in Unmagnetized Weakly Ionized Plasmas, O. Troll, L. Conde, E. Criado, J. M. Donoso, G. Herdrich, Contributions to Plasma Physics, Vol. 50, No. 9, Seiten 819-823, 2010.

- Nonlinear Magnetoplasmons in Strongly Coupled Yukawa Plasmas*, M. Bonitz, Z. Donkó, T. Ott, H. Kahlert, P. Hartmann, Phys. Rev. Lett., 105, 055002; IF: 7.621, 2010.
- On the Benefit of University Small Satellites and Flight Opportunities through International Collaboration*, R. Laufer, T. W. Hyde, G. D. Earle and R. Sandau, NASA White Paper for the 2010-2011 Decadal Survey on Solar and Space Physics, National Research Council, November, 2010.
- Operational behavior and application regime assessment of the magnetic acceleration plasma facility IMAX*, G. Herdrich, M. Fertig, D. Petkow, S. Kraus, S. Löhle, and M. Auweter-Kurtz, Vacuum 85, pp. 563-568, 2010.
- Particle Wall Interactions in Dusty Hypersonic Entry Flows*, A. Majid, U. Bauder, M. Fertig, G. Herdrich, and H. P. Röser, Frontier of Applied Plasma Technology, Vol. 3, No. 1, January 2010.
- Review of pulsed plasma thruster development at IRS*, T. Schönherr, A. Nawaz, M. Lau, D. Petkow, and G. Herdrich, Transactions of the Japan Society for Aeronautical and Space Sciences, Aerospace Technology Japan, Vol. 8, No. 27, 2010.
- Small mass expansion of functional determinants on the generalized cone*, K. Kirsten and G. Fucci, J. Phys. A: Math. Theor. 43, 365204 (22 p), 2010.
- Small satellites for global coverage: Potential and limits*, R. Sandau, K. Briess, and M. D'Errico, ISPRS Journal of Photogrammetry and Remote Sensing 65, 492-504, 2010.
- Spacetime Singularities in String and its Low Dimensional Elective Theory*, P. Sharma, A. Tziolas, A. Wang, and Z.-C. Wu, Inter. J. Mod. Phys. A 26, 273-300, 2011.
- Spectroscopic Investigation of an Inductively Heated CO₂ Plasma for Mars entry simulation*, S. Löhle, S. Lein, Ch. Eichhorn, G. Herdrich, M. Winter, eingereicht beim Journal of Technical Physics, January 2010.
- Stability of the de Sitter spacetime in Horava-Lifshitz theory*, Y. Q. Huang, A. Wang, and Q. Wu, Mod. Phys. Lett. A 25, 2267-2279, 2010.
- Status and trends of small satellite missions for Earth observation*, R. Sandau, Acta Astronautica 66, 1-12, 2010.
- The effect of secondary electrons on the separate control of ion energy and flux in dual-frequency capacitively coupled radio frequency discharges*, Z. Donkó, J. Schulze, P. Hartmann, I. Korolov, U. Czarnetzki, E. Schüngel, Appl. Phys. Lett., 97, 081501; IF: 3.554, 2010.

Presentations (2010)

- A Simple Method to Measure the Interaction Potential of Dielectric Grains*, Z. Zhang, K. Qiao, J. Kong, L. Matthews, T. W. Hyde, presented at the APS Division of Plasma Physics, Chicago, IL, 2010.
- A Systematic, Statistical Search of Gauge Content in Free Fermionic Heterotic String Models*, G. Cleaver, T. Renner, J. Greenwald, and D. Moore, presented at the String Vacuum Project Fall 2010 meeting at Ohio State University, Nov. 5-8, 2010.
- About the potential of small satellites for global environmental impact monitoring*, R. Sandau, 1st IAA-SGEI Workshop, Beijing, China, June 1-2, 2010.
- Capacity building of space emerging countries: IAA Strategy for the next decade*, J.M. Contant, R. Sandau, ISPRS-Symposium, Commission VIII, Kyoto, Japan, August 7-14, 2010.
- Charging of Aggregates in the Heliosphere*, Q. Ma, V. Land, L. S. Matthews, and T. W. Hyde, presented at the APS Division of Plasma Physics, Chicago, IL, 2010.
- Collective modes in strongly coupled binary liquids*, G. J. Kalman, Z. Donkó, P. Hartmann, K. I. Golden, and S. Kyrkos, pp. 45 in: Book of Abstracts of the Strongly Coupled Coulomb Systems conference (ISBN 978-963-88019-5-1), Budapest, Hungary, July 24-29, 2010.
- Collective dynamics of complex plasma bilayers*, P. Hartmann, Z. Donkó, G. J. Kalman, S. Kyrkos, K. I. Golden, M. Rosenberg, pp. P3.03 in Proceedings of the 20th European Conference on the Atomic and Molecular Physics of Ionized Gases (ESCAMPIG XX, ISBN 2-914771-63-0), Novi Sad, Serbia, July 13-17, 2010.
- Conducting and Non-Conducting Grains in a Complex Plasma*, J. Carmona-Reyes, L. Matthews, T. W. Hyde, presented at the APS Division of Plasma Physics, Chicago, IL, 2010.
- Conducting particles within a dusty plasma*, J. Carmona-Reyes, L. Matthews, and T. Hyde, poster presented at the APS Division of Plasma Physics, Chicago, IL, 2010.
- Cosmology on the Edge*, G. Cleaver, invited lectures, BIC 2447 Natural World II, September 13 & 15, 2010.
- Cosmic Acceleration and Bouncing Universe in Brane Cosmology of String/M Theory*, A. Wang, School of Physics, University of Science and Technology of China, July 9, 2010.

- Distributed space systems – constellations or formations?*, R. Sandau, 1st Nano-Satellite Symposium, Tokyo, Japan, June 10-11, 2010.
- Effects of Charged-Magnetic Grains in Protoplanetary Disks*, J. Perry, L. Matthews, T. W. Hyde, presented at the APS Division of Plasma Physics, Chicago, IL, 2010
- Equilibrium structure and perturbative dynamics of three-dimensional dust clouds suspended in a glass box*, S. Wood, V. Land, J. Carmona-Reyes, J. Schmoke, M. Cook, L. Matthews, T. W. Hyde, presented at the APS Division of Plasma Physics, Chicago, IL, 2010
- Heat trace asymptotics with regular and singular weight functions*, K. Kirsten, Conference on Topics in Spectral and Scattering Theory, Penn State University, State College, PA, USA, August 9-13, 2010.
- Interactions Between Multiple Sized Particle Bilayers*, A. Douglass, B. Doyle, V. Land, L. Matthews, and T. W. Hyde, presented at the APS Division of Plasma Physics, Chicago, IL, 2010
- Investigations of the String Landscape*, G. Cleaver, School of Physics, University of Science and Technology of China, July 13, 2010.
- Langmuir probe measurements of electron density and electron temperature in argon glow discharges - applications in discharge modeling*, I. Korolov, A. Derzsi, P. Hartmann, J. Karácsonyi, G. Bánó, Z. Donkó, pp. P2.19 in Proceedings of the 20th European Conference on the Atomic and Molecular Physics of Ionized Gases (ESCAMPIG XX, ISBN 2-914771-63-0), Novi Sad, Serbia, July 13 - 17, 2010.
- Low-Velocity Impacts on PVDF Targets Using a Light Gas Gun*, J.A. Carmona, M. Cook, J. Schmoke, R. Laufer, L. S. Matthews and T. W. Hyde, in Lunar and Planetary Science XXXXI, Lunar and Planetary Science Conference, Houston, Texas, 2010.
- Measurements of DC Bias in Thermophoresis Experiments*, V. Land, J. Carmona-Reyes, J. Creel, J. Schmoke, M. Cook, L. S. Matthews, T. W. Hyde, presented at the APS Division of Plasma Physics, Chicago, IL, 2010
- Melting and Freezing of Dust Crystals – Experiment and Theory*, P. Hartmann, A. Kovács, Z. Donkóoltán, K. Gabor, A. Douglass, L. Matthews, J. Carmona-Reyes and T. W. Hyde, presented at the 2nd Graduate Summer Institute on Complex Plasmas, Greifswald, Germany, 2010.
- Mode Spectra and Mode Conversion of Dust Particle Clusters in Complex Plasmas*, K. Qiao, T. W. Hyde, L. Matthews, J. Kong, A. Douglass, Z. Zhang, presented at the APS Division of Plasma Physics, Chicago, IL, 2010.
- On the Correlation of Extra MSSM Higgs to Stringent Flat Directions in Heterotic String Theory*, G. Cleaver, T. Renner, J. Greenwald, and D. Moore, presented at the String Vacuum Project Fall 2010 meeting at Ohio State University, Nov. 5-8, 2010.
- Probe Induced Dust Crystal Voids in Complex Plasma*, B. Harris, N. Walker, J. Carmona-Reyes, J. Schmoke, L. Matthews, T. W. Hyde, presented at the APS Division of Plasma Physics, Chicago, IL, 2010
- Small Satellites – a driver for capacity building*, R. Sandau, presented at the 1st IAA Regional Symposium on Small Satellites, Buea, Cameroon, December 5-7, 2010.
- Spectral functions: Techniques and Applications (The ugly business of heat kernel coefficients.)*, K. Kirsten, Conference in Geometry and Global Analysis, Santiago de Compostela, Spain, December 13 – 17, 2010.
- Spectrum Studies of a One-Dimensional Vertical Dust String*, J. Kong, T. W. Hyde, L. Matthews, K. Qiao, Z. Zhang, presented at the APS Division of Plasma Physics, Chicago, IL, 2010
- Systematic approach to design small satellites for specific Earth observation tasks*, R. Sandau, J. M. Contant, IAA Symposium on the Equatorial Plane, Abuja, Nigeria, November 30-December 2, 2010.
- Systematic Extensions of the NAHE and NAHE Variation in the Free Fermionic String Landscape*, G. Cleaver, T. Renner, J. Greenwald, and D. Moore, presented at the, String Vacuum Project Fall 2010 meeting at Ohio State University, Nov 5-8, 2010.
- The CASPER Physics Circus; A Replicable Model for Building Capacity*, C. Hernandez, T. Hyde, and J. Carmona-Reyes, GEAR UP State Conference, Corpus Christi, Texas, November 10, 2010.
- The Casimir effect – On the evaluation of sums and why anyone cares*, K. Kirsten, Baylor University, Waco, TX, USA, August 25, 2010.
- The DC bias in complex plasma experiments involving thermophoresis*, V. Land, J. C.-Reyes, J. Creel, J. Schmoke, M. Cook, L. Matthews, and T. Hyde, poster presented at the APS Division of Plasma Physics, Chicago, IL, 2010
- The Greatest Show on Earth*, J. Carmona-Reyes, C. Hernandez, and T. W. Hyde. presented at the APS Division of Plasma Physics, Chicago, IL, 2010.
- TIROSS-An Academic Small Satellite Program for Scientific Earth-Moon System Investigations*, R. Laufer, T. W. Hyde, Michael Lachenmann and H.P. Röser, International Astronautical Federation, Prague, Czech Republic, 2010.

Former CASPER research assistant leads summer science camp for under-served youth

Former CASPER Research Assistant Dr. Edith Davis (pictured third from left), now an assistant professor of science education at Florida A&M University (FAMU), recently received an \$80,000 grant from ExxonMobil to support her work with the ExxonMobil Bernard Harris Summer Science Camp hosted by FAMU.

The camp was founded by Dr. Bernard A. Harris, Jr., a veteran astronaut who was the first African American to walk in space. FAMU is one of 25 universities that host under-served youth for the two-week summer program. Under Dr. Davis' leadership, students get to experience life on a college campus while gaining hands-on experience in science, technology, engineering, and math (STEM) fields.



CASPER alum heads \$3 million research project



Dr. Troy Henderson earned his bachelor's degree in physics and math at Baylor in 2000, and went on to earn his master's and Ph.D. degrees in aerospace engineering at Texas A&M. He is currently an assistant professor of aerospace and ocean engineering at Virginia Tech. His research focuses on design and optimization of spacecraft and space missions.

Dr. Henderson is currently the PI on a \$3 million cooperative agreement between Virginia Tech and the Space and Naval Warfare System Center (SPAWAR), one of three Department of Navy acquisition commands responsible for delivering information technology products and services to the Navy and other Department of Defense stakeholders.

Along with other faculty members, Dr. Henderson will perform research on communications, intelligence, surveillance, and reconnaissance, aimed at helping the U.S. military maintain information superiority.

Graduations

Michael Devin successfully defended his dissertation, *Orbifold Branes in String Theory and Their Applications to Cosmology*, and graduated from Baylor with a Ph.D. in Physics in August, 2011.

Theresa Ma successfully defended her dissertation, *Charging of Aggregate Grains in Astrophysical Environments* in October. She graduated from Baylor with a Ph.D. in Physics in December, 2011.

Alex Price successfully defended his master's thesis and graduated from Baylor with an M.S. in Physics in August, 2011.

Tim Renner successfully defended his doctoral dissertation, *Initial Systematic Investigations of the Weakly Coupled Free Fermionic Heterotic String Landscape Statistics* and graduated from Baylor with a Ph.D. in Physics in August, 2011.

Babies



Malcom Gregory Swint was born April 20, 2011 to Ethan and Pamela Swint.

7 lbs, 12 oz and 21" long.



BAYLOR
UNIVERSITY

CENTER FOR ASTROPHYSICS,
SPACE PHYSICS & ENGINEERING RESEARCH

One Bear Place #97310
Baylor University
Waco, Texas 76798-7310
<http://www.baylor.edu/CASPER>
(254) 710-3763 (voice)
(254) 867-3167 (voice)
(254) 710-7309 (fax)

CHANGE SERVICE REQUESTED



Hypervelocity Impacts & Dusty Plasmas Lab
Space Science Lab

3801 Campus Drive
Waco, TX 76705
<http://www.baylor.edu/CASPER>
(254) 867-3167 (voice)
(254) 710-3763 (voice)
(254) 867-DUST (fax)

NONPROFIT
ORGANIZATION
U.S. POSTAGE
PAID
**BAYLOR
UNIVERSITY**

In This Issue

NASA Artifacts at the BRIC
CASPER Equipment
CASPER/UT-Dallas MOU Extended
BRIC Construction Update
Group Updates
Research Updates
Mathematics Workshop
CASPER Courses
Honors & Awards
New CASPER Members
Seminar Speakers
CASPER Summers
Physics Circus
Publications/Presentations
Personnel Updates

2011 • Volume XII

CASPER

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