



CASPER

Center for Astrophysics,
Space Physics & Engineering Research



BAYLOR

Since its inception in 1999,

Baylor's Center for Astrophysics, Space Physics and Engineering Research (CASPER) has welcomed highly regarded researchers and students from all over the world into a community of colleagues who share a common devotion to discovery.

CASPER's wide array of advanced instrumentation and capacity for theoretical research offer a broad, rich research environment for seasoned investigators, students and corporate partners alike — all within the context of a major American research university.

Baylor is a member of the Universities Space Research Association, a private, international nonprofit consortium established in 1969 by the National Academy of Sciences to stimulate and advance research and education in the space sciences. Membership in this elite group — which includes such recognized research institutions as Caltech, University of Stuttgart, Harvard, MIT, Rice and Yale — affords CASPER researchers unique opportunities for interdisciplinary collaborations with many of the world's foremost scientists and researchers.

CASPER's theoretical and experimental research groups apply a diverse and comprehensive array of resources for scientific inquiry ranging from the most fundamental to the highly complex.

Theoretical Groups

- » **Astrophysics and Space Science Theory Group**
- » **Early Universe Cosmology and Superstrings Group**
- » **Gravity, Cosmology and Astroparticle Physics Group**

Theoretical Research Topics

- » Astrophysics
- » Space physics
- » Complex (dusty) plasmas
- » Cosmology
- » Gravitoelectrodynamics
- » Superstring/M-theory
- » Protoplanetary/protostellar formation
- » Gravitation

Experimental Groups

- » **Hypervelocity Impacts and Dusty Plasmas Lab**
- » **Space Science Lab**
- » **Meyer Observatory**

Experimental Research Topics

- » Complex (dusty) plasmas
- » Pulsating white dwarfs and subdwarfs
- » In-situ instrumentation development
- » Self-assembling mesoscale systems
- » Nanofabrication
- » Shock physics

education

Academically, CASPER offers students a number of challenging and rewarding paths to degrees across a broad range of fields.

Baylor University

School/Department	Degree(s)	Major/Concentration(s)
Department of Physics	PhD, MS, BS, BA	Physics
	BA, BS	Astronomy & Astrophysics
	BS	Physics/Computational
	BS	Physics/Pre-Healthcare
Department of Mathematics	PhD, MS, BS, BA	Mathematics
	BS	Applied Mathematics
School of Engineering	PhD, MS, BS	Mechanical Engineering
	PhD, MS, BS	Electrical & Computer Engineering
School of Education	Edd, MEd, MA, BSEd	Science education

Texas State Technical College Waco

Degree	Major/Concentration(s)
Associate of Applied Science	Laser electro-optics, nanofabrication, semiconductor manufacturing, electrical systems, robotics, instrumentation

collaborations & partnerships

CASPER researchers enjoy an expansive network of local, national and worldwide resources. An agreement with Texas State Technical College Waco gives CASPER researchers access to that institution's expertise and infrastructure in laser electro-optics, robotics, advanced manufacturing, semiconductor manufacturing and nanofabrication.

Similarly, through CASPER's partnership with the Central Texas Astronomical Society researchers have access to the Paul and Jane Meyer Observatory located less than an hour away in the hills outside Clifton, Texas. That agreement also enables collaboration with University of Texas scientists at UT's McDonald Observatory in the remote Guadalupe Mountains of West Texas.

Since 2007, scientists and engineers from Baylor and the University of Stuttgart's Institute of Space Sciences have collaborated in the design of compact "nano-satellites" and conducted interdisciplinary research in plasma science, remote sensing technologies, airborne platforms and in situ instrumentation. Each year a dozen or more graduate students travel from Germany to conduct research at CASPER as a part of their degree programs. A resident University of Stuttgart professor and researcher directs CASPER's Space Science Laboratory.

In addition, CASPER's network of international partners comprises researchers in China, Brazil, Greece, Russia, and India, among other nations. In 2014, Dr. Oleg Petrov, Dr. Vladimir Nosenko and Dr. Peter Hartmann accepted appointments as assistant research directors at CASPER. The three scientists are members of the Russian, Ukrainian and Hungarian academies of science, respectively.



facilities

Research Facilities

CASPER researchers operate from the 330,000-square-foot Baylor Research and Innovation Collaborative (BRIC). The BRIC provides an interdisciplinary research environment designed to promote collaborative research through attractive, well-equipped offices and meeting spaces, fully equipped research laboratories, and conversation niches where students and faculty across disciplines interact casually with one another. The BRIC already is home to more than a half-dozen partnering university and corporate research units.



Experimental Research Facilities

CASPER's Hypervelocity Impacts and Dusty Plasma Lab (HIDPL) experimental group operates three GEC RF reference cell plasma experimentation systems, one of which features a Zyvex S100 nanomanipulator. The cells can be configured for either RF or DC operation and are controlled using a National Instruments LabVIEW interface.

The HIDPL also maintains an inductively driven plasma generator (IPG) capable of electrodeless generation of high-enthalpy plasmas at powers of up to 15 kW and a light gas accelerator used in studies of low velocity particle impact forces, trajectories and craters. Data from these studies is used in designing particle sensors and assessing the durability of materials used in space. Optical equipment includes two frequency-doubled Nd:YVO4 lasers (Coherent-Verdi) and a Ti:Sapphire laser.

CASPER researchers make observations and conduct experiments with the Paul and Jane Meyer Observatory's 24-inch Ritchey-Chretien Cassegrain telescope. The telescope features research grade CCD cameras and filters and full remote operation of all functions. Imaging software and access to Advanced Composition Explorer databases support research in astrometry, photometry and spectral analysis.

outreach

Research Experiences for Undergraduates (REU)

Jointly funded by Baylor and the National Science Foundation, the CASPER REU program brings undergraduates from around the world to conduct research alongside CASPER researchers. REU fellows receive living and travel expenses and a stipend for the 10-week summer program.

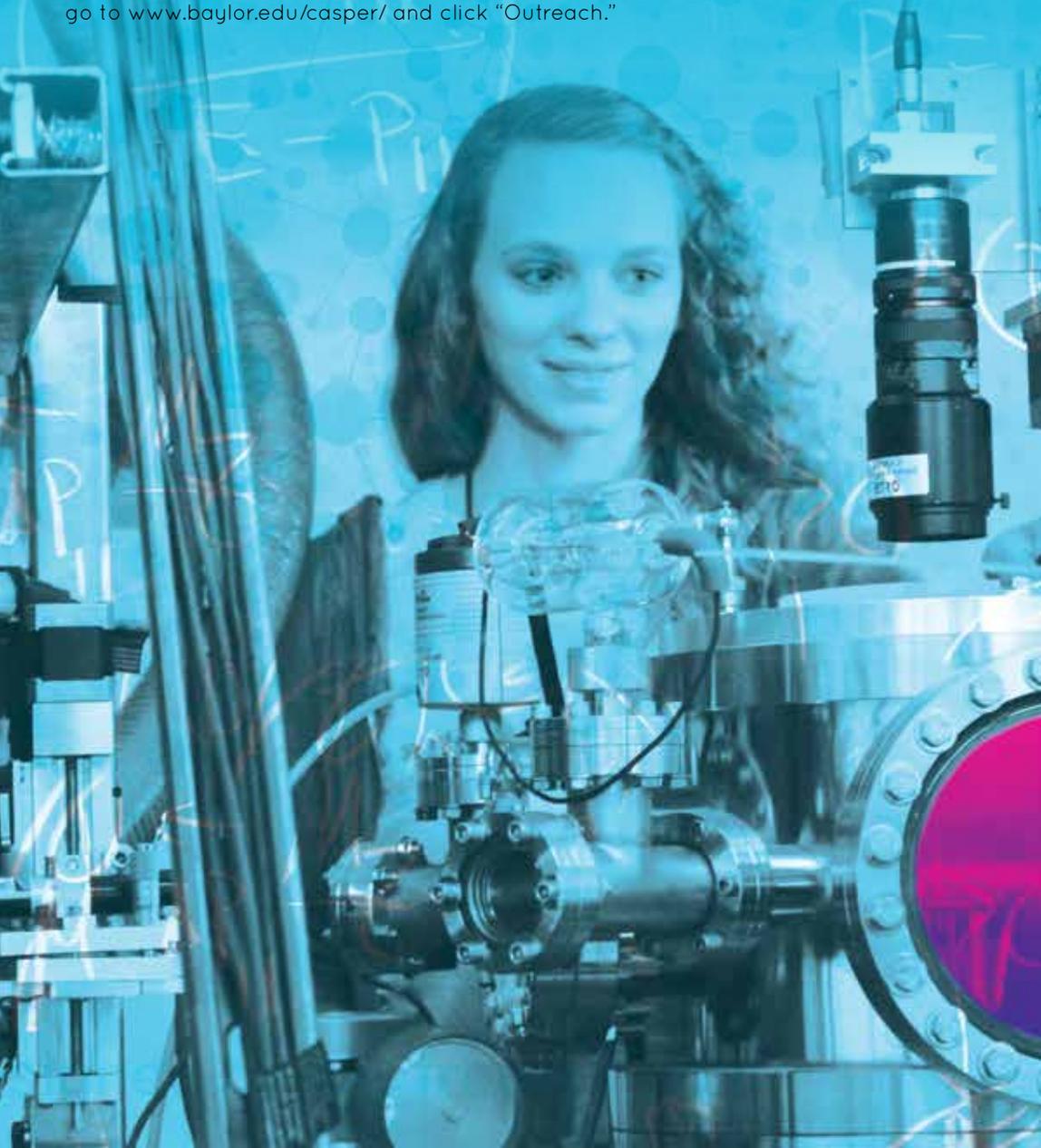
Research Experiences for Teachers (RET)

This companion to the REU program invites teachers from the elementary, middle, high school and community college levels to CASPER for eight weeks during the summer. Teachers may work with any of the active research groups, develop new science curricula or participate in one of a variety of courses designed to help them hone their classroom skills. RET fellows are paid two months of their annualized salary for their participation in the program, with flexible starting and ending times to facilitate their teaching schedules.

Summer Programs for High School Students

CASPER's Summer High School Scholars Program provides local advanced placement high school students with an opportunity to experience hands-on interdisciplinary research. Selected participants conduct research alongside REU and RET fellows, graduate students and research faculty.

For more information on CASPER's REU, RET and High School Scholars programs go to www.baylor.edu/casper/ and click "Outreach."



faculty & staff

Faculty

Truell W. Hyde, CASPER Director
William B. “Trey” Cade
Dick Campbell
Gerald Cleaver
Randy Hall
Peter Hartmann
Klaus Kirsten
Jeff Lee
Greg Leman
Constanze Liaw

Lorin Matthews
Ray Nazzario
Vladimir Nosenko
Oleg Petrov
Dwight Russell
Qin “Tim” Sheng
John Vasut
Anzhong Wang
Yumei Wu

Adjunct Faculty

David Lary (University of Texas Dallas)
Emmanuel Saridakis
Georg Herdrich (University of Stuttgart)
Jianxin Lu (University of Science and Technology of China)
John Fitch (Birkeland Current)
Marlene Rosenberg (University of California San Diego)
Nilton Oscar Santos (MCT Petropolis)
Phillip Anz-Meador (NASA JSC)
Rainer Sandau (German Aerospace Center, International Academy of Astronautics)
Ralf Srama (University of Stuttgart, Max Planck Institute, Heidelberg)
Rong-Gen Cai (Chinese Academy of Sciences)
Sean Casey
Yungui Gong (Chongqing University of Posts and Telecommunications)

Research Faculty, Visiting Faculty, Postdocs & Staff

Augusto Carballido
Jorge Carmona-Reyes
Mike Cook
Michael Dropmann
Jie Kong
Rene Laufer
Zhong-Heng Li (visiting, from Zhejiang University of Technology)
Ke Qiao
Jimmy Schmoke
Miao Tian (visiting, Lanzhou Jiaotong University)
Li Wang
Jie Yang (visiting, Lanzhou Jiaotong University)
Tao Zhu

CASPER represents a large cross-section of centers and departments, including physics, business, engineering, information technology, mathematics, education, and more.

To view curriculum vitae for CASPER researchers go to www.baylor.edu/casper and click on “People,” then click the name of the person.

for more information

CASPER

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For information regarding a specific program within CASPER, visit www.baylor.edu/casper or the appropriate program website.

To apply for admission to Baylor's graduate school, go to www.baylor.edu/graduate/application.

To ensure full consideration, please return all documents by February 15.

NASA/Texas Space Grant Consortium Fellowships

Graduate fellowship awards of \$5,000 are available for students studying within the Center to supplement the base graduate support provided by Baylor University. The award is for one year and may be renewed for a maximum of three, providing the recipient has spent no more than two years as a master's candidate. Applicants must be citizens of the United States and registered as a full-time student.

Columbia Crew Memorial Undergraduate Scholarships

Undergraduate scholarships are available for students studying within the Center to recognize high academic achievers and encourage their interest in future graduate studies in a space science, technology, engineering, or mathematics field.

Information for both programs is available at www.baylor.edu/casper or www.tsgc.utexas.edu/grants.

