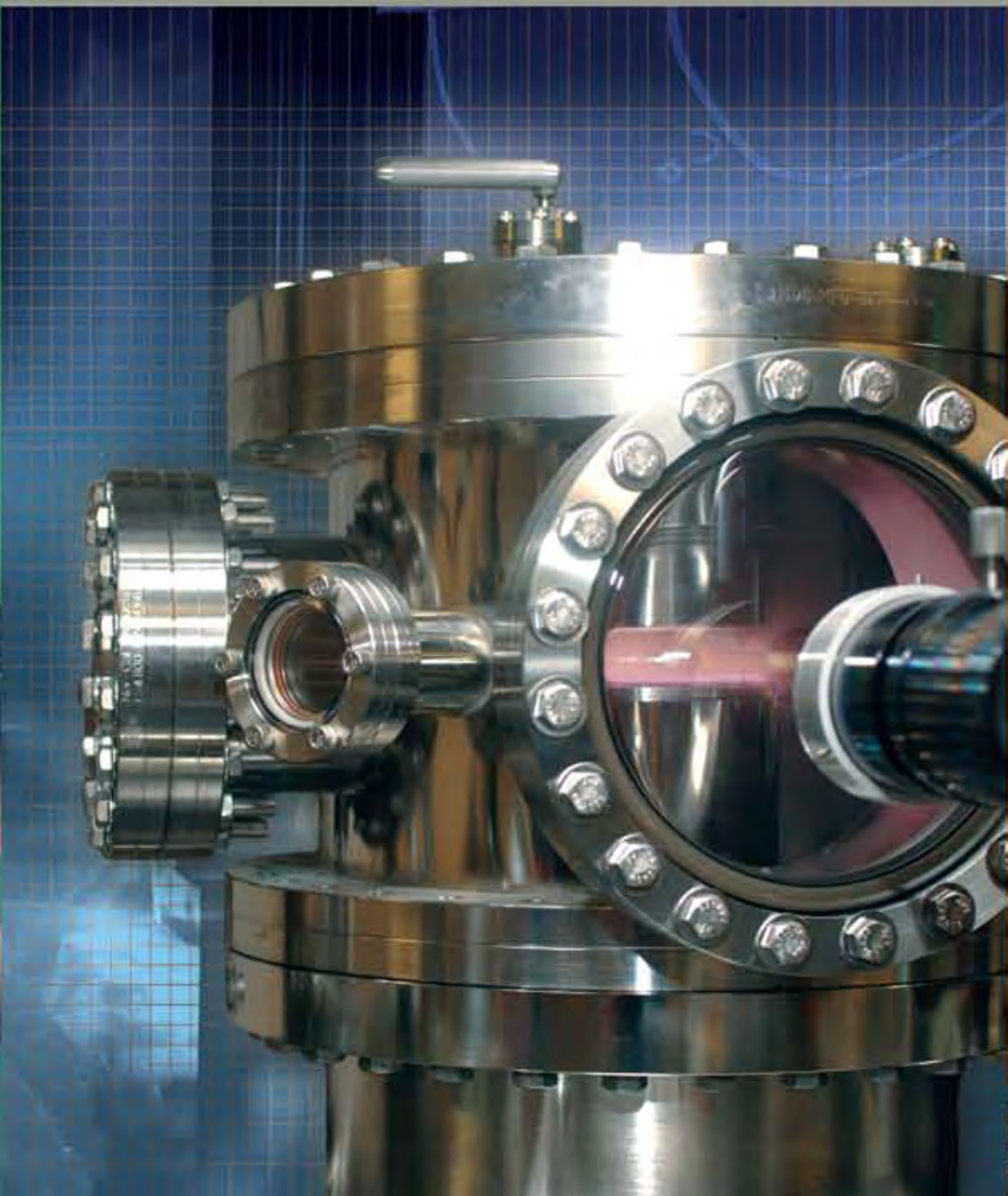
casper

Center for Astrophysics, Space Physics
& Engineering Research

BAYLOR UNIVERSITY

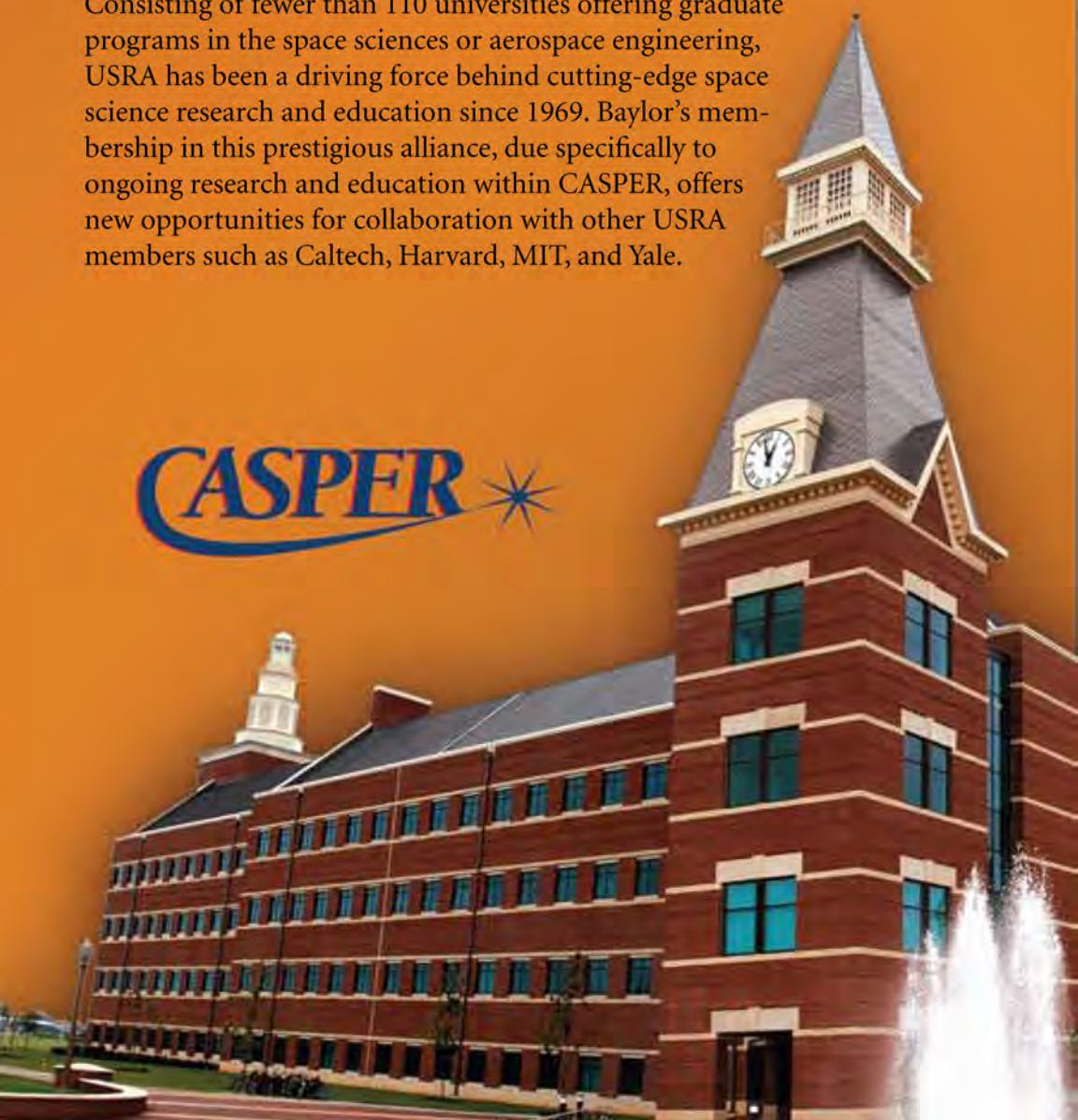


Those who join the Center for Astrophysics, Space Physics and Engineering Research (CASPER) find an energetic community of scholars pursuing world-class research in state-of-the-art facilities.

The Center provides challenging opportunities with programs for undergraduates, graduates, corporate partners, visiting research scientists, and in-service and pre-service teachers from the K-12 community. Academic excellence, real-world laboratory environments, a national lab paradigm, and a hands-on research team experience are some of the hallmarks of CASPER.

In 2006, the Carnegie Foundation for the Advancement of Technology awarded Baylor University new standing as a "research university" with "high" research activity. Baylor progressed to this prestigious status by attaining excellence in many areas including research and development expenditures, science staffing levels, and the number of doctorates awarded per year.

Even more specific to CASPER, in 2005 Baylor was admitted to an elite group – the Universities Space Research Association, a private nonprofit consortium established by the National Academy of Sciences. Consisting of fewer than 110 universities offering graduate programs in the space sciences or aerospace engineering, USRA has been a driving force behind cutting-edge space science research and education since 1969. Baylor's membership in this prestigious alliance, due specifically to ongoing research and education within CASPER, offers new opportunities for collaboration with other USRA members such as Caltech, Harvard, MIT, and Yale.



The Center for Astrophysics, Space Physics and Engineering Research

was established in 1999 and features an interdisciplinary approach throughout its three theory groups: the Astrophysics and Space Science Theory Group; the Early Universe Cosmolgy and Superstrings Group; and the Gravity, Cosmology and Astroparticle Physics Group. It also includes three experimental labs: the Hypervelocity Impacts and Dusty Plasmas Lab, the Space Science Lab, and the Meyer Observatory.

CASPER partnerships outside of Baylor provide support across a variety of research and educational environments. Technical support is provided as part of a collaboration between Baylor University and Texas State Technical College Waco, blending CASPER's research programs with TSTC infrastructure in laser electro-optics, robotics, advanced manufacturing, semiconductor manufacturing, and nanofabrication. CASPER's parternership with the Central Texas Astronomical Society provides students and faculty access to the Paul Meyer Observatory outside of Waco near Clifton, Texas, with its fully instrumented 24-inch research grade telescope. This brings with it collaborative research opportunities with the University of Texas' McDonald Observatory.

Other current and past CASPER corporate and educational partners include Coherent, Lawrence Livermore National Lab, Quantronix, Rice University, Sandia National Lab, SEMATECH, Southwestern Medical Center, Texas Instruments, the University of Houston, University of Texas Medical Branch, and Zyvex, among others. Currently, CASPER is funded by multiple funding agencies, including the Department of Education, NASA, and the National Science Foundation.

the program

Students in CASPER can choose from a variety of degree options, including the PhD, MS, or BS in physics or the BA and BS in astronomy and astrophysics within the Department of Physics. The PhD, MS and BS in mathematics and the BS in applied mathematics are available through the Department of Mathematics. The BS and MS in mechanical engineering and ECE are available through the School of Engineering, while the BSEd, MSEd, MA, and EdD are available through the School of Education. Through TSTC Waco, CASPER offers the AAS in laser electro-optics, semiconductor manufacturing, nanofabrication, electrical systems, robotics, and instrumentation.

the research

Program research options include experimental concentrations in space physics, complex (dusty) plasma physics, nanophysics, and impact (shock) physics with theoretical concentrations in astrophysics, complex (dusty) plasma physics, shock physics, space physics, string theory, and string/brane cosmology. Educational research in curriculum and instruction also is available.

For more information on specific courses of instruction,
visit www.baylor.edu/casper.

facilities

Theoretical Research Facilities

Theoretical research groups within CASPER are housed in the new five-story, $103-million Baylor Sciences Building. In addition to classrooms and offices, the building includes 90 research laboratories, state-of-the-art technology and instrumentation, and informal areas where students and faculty from all departments can interact with one another. Researchers within the Center have access to a variety of advanced computing cluster platforms as well as access through Internet2 connections to off-campus supercomputer facilities.

Experimental Research Facilities

CASPER operates out of a fully integrated research, education, and outreach environment. Undergraduates work alongside visiting students and faculty from other universities, middle or high school students, pre-service and in-service teachers, as well as corporate research partners. In addition to dedicated lab, office, and conference room space within the Baylor Sciences Building, experimental research groups have access to over 10,000 square feet of laboratory space located in two stand-alone buildings on the TSTC Waco campus as well as the Paul and Jane Meyer Observatory.

The Hypervelocity Impacts and Dusty Plasmas Lab (HIDPL) and the Space Science Lab (SSL) are co-located in a stand-alone building at TSTC. The SSL employs three particle (μ to mm size regime) accelerators to study shock physics, advanced spacecraft shielding, and in-situ instrumentation design for deep-space probes. The HIDPL is equipped with two GEC RF Reference Cell experimental systems. Both cells are equipped for RF or DC operation and are fully instrumented with the Labview interface system. Additional diagnostic capability includes a Zyvex S100 nanomanipulator system, a Coherent Verdi laser system, and multiple other laser systems.

Since many of the CASPER technical staff previously worked in a national lab, students are provided with superb technical support and the opportunity to learn new technical skill sets. Students working in any of the experimental areas above are supported by machine and electronics shops located within the lab, as well as full-time machine and electronics technicians.

The Paul and Jane Meyer Observatory at the Turner Research Station is located near Clifton, Texas, and contains a 24-inch Ritchey-Chretien telescope. This state-of-the-art observatory includes research-grade CCD imaging cameras and professional filters. ACE software controls all telescope functions, allowing 100 percent remote operation including pointing, guiding, filter selection, dome control, and camera control. Imaging software and ACE databases support research programs in astrometry, photometry, and spectral analysis. The observatory is operated by the Central Texas Astronomical Society, a CASPER partner.

research areas

Theoretical

Astrophysics
Complex (dusty) plasmas
Gravitoelectrodynamics
Protoplanetary/protostellar formation
Space physics
String/brane cosmology
Superstring/M-theory

Experimental

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

outreach

Research Experiences for Undergraduates (REU)

This program is supported by Baylor and the National Science Foundation and allows undergraduates from around the world to participate in research within the Center or the physics department at Baylor. NSF fellows are paid a stipend along with living and travel expenses for 10 weeks of the summer. Fully furnished housing is available at a reduced rate for participating fellows.

Research Experiences for Teachers (RET)

This NSF-funded program allows elementary, middle, high school, and community college science teachers to work within CASPER for a summer. Teachers can elect to work with any of the active research groups, develop hands-on science curriculum, interact as part of the Physics Circus team, or take one of a variety of courses designed to help them in the classroom. They are paid two months of their annualized salary for the summer period, with flexible starting and ending times available. Depending on the availability of funding, the RET Fellowship may be continued through the academic year if desired. Graduate-level coursework also is available through CASPER's partnership with Baylor's School of Education.

High School Summer Programs

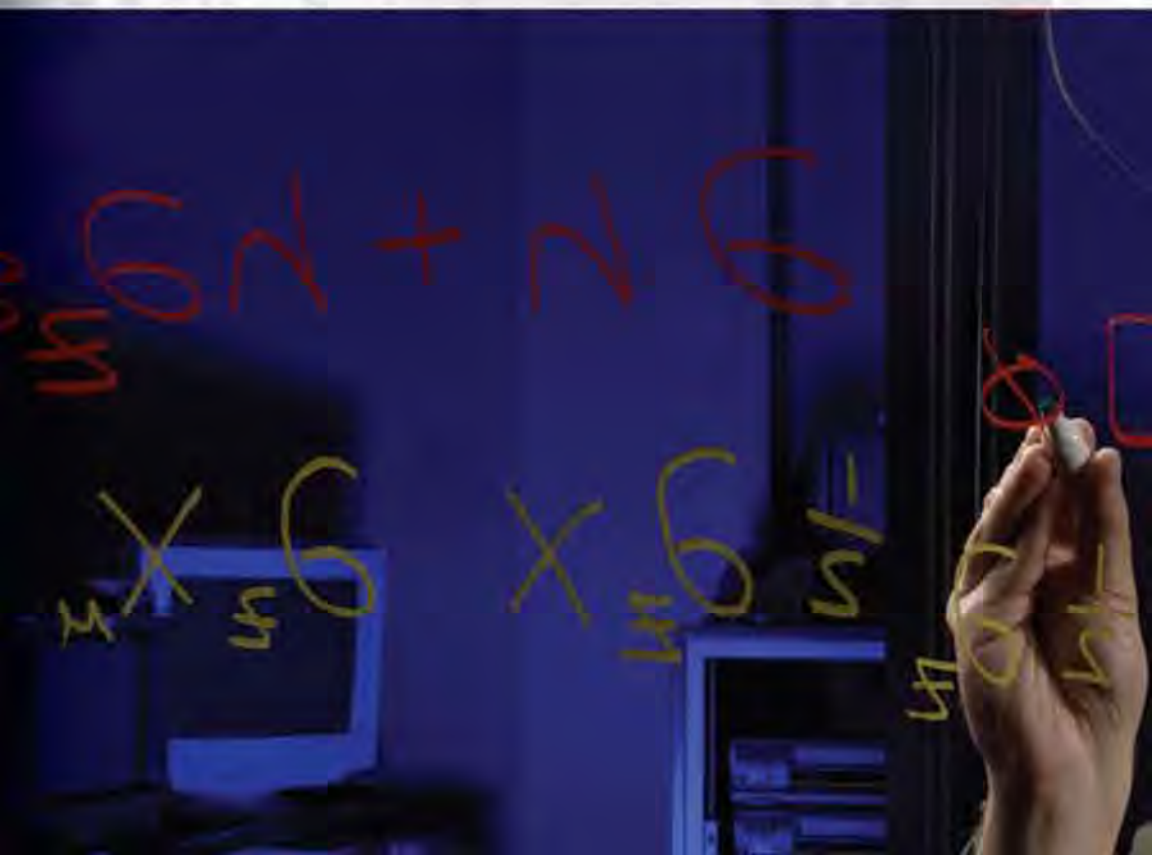
While the following two programs are very similar, they originate in different offices.

High School Summer Science Research Program

This program is conducted through the Office of the Dean of the College of Arts and Sciences. Juniors and seniors attend class at Baylor during the summer for credit and can select CASPER as their research area. More information can be found at www.baylor.edu/summerscience.

High School Scholars Program

Outstanding high school students can become involved with one of CASPER's research groups during the summer. Fellows are paid a weekly stipend and may enroll in specialized classes for college credit offered through CASPER. Additional research areas exist through concurrent enrollment, tech prep, and other high school partnership efforts conducted by Baylor University and TSTC Waco.



The Physics Circus

The CASPER Physics Circus brings together the best of performance, science demonstration, and hands-on experiences to provide elementary, middle, and high school students an interactive, multimedia science experience to remember. Employing tesla coils, Van de Graaff generators, and more, CASPER students from Baylor University and TSTC involve the audience in a hair-raising exploration of electricity, magnetism, acoustics, waves, motion, and light. A laser light show provides a grand finale to this one-hour performance. Following the show, participants are provided access to the demonstrations, along with science exhibits built by CASPER interns.
Visit www.baylor.edu/physicscircus for more information.

for more information:

CASPER
Truell Hyde, Director
Baylor University
One Bear Place #97310
Waco, Texas 76798-7310

(254) 710-3763
www.baylor.edu/casper
Truell_Hyde@baylor.edu

For information regarding a specific program within CASPER, go to the CASPER site or the appropriate program Web site. 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.

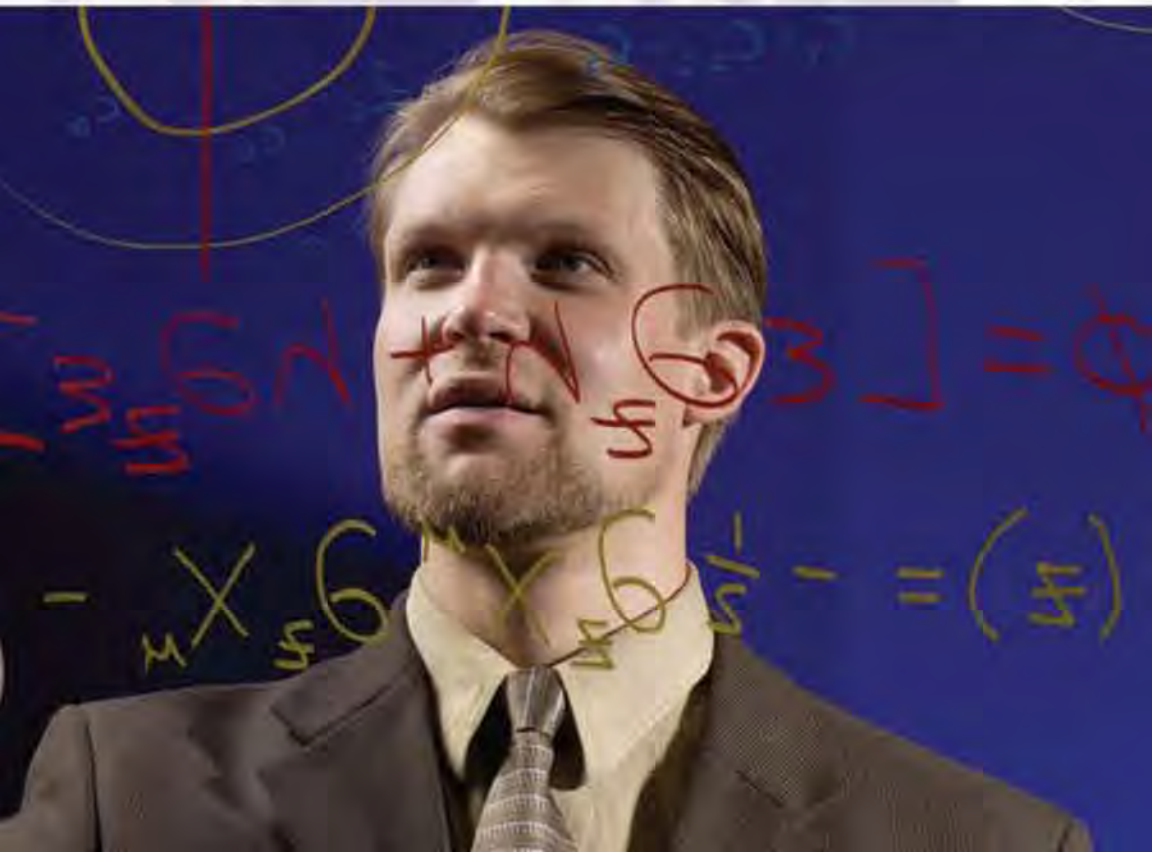
NASA/Texas Space Grant Consortium Fellowships

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.



faculty and staff

Baylor Faculty & Staff

Truell W. Hyde
Tibra Ali
Dick Campbell
Jorge Carmona-Reyes
Gerald Cleaver
Mike Cook
Crista Force
Cyndi Hernandez
Jie Kong
Victor Land
Rene Laufer
Greg Leman
Lorin Matthews
Ray Nazzario
Ke Qiao
Jimmy Schmoke
Qin Sheng
Bernard Smith
John Vasut
Anzhong Wang
Yumei Wu

TSTC Waco

Tommy Harper
Terry Kleypas
John Simcik

NASA JSC

Phillip Anz-Meador

MCT Petropolis

Nilton Oscar Santos

Chinese Academy of Sciences

Rong-Gen Cai

Chongquing University of Posts and Telecommunications

Yungui Gong

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

Curriculum vitas for the above are listed at www.baylor.edu/casper

BAYLOR UNIVERSITY

05128VPR 04.09