

## TENNESSEE STATE UNIVERSITY

### GENERAL

### Capabilities Statement

**DUNS No:** 10-881-4179      **Cage Code:** 1E6S0      **Federal EIN No:** 62-0786119

**NAICS ID(s):** 611310, 541330, 541710/541712, 927110      **SIC:** 8733, 8221

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### Institutional Snapshot

Founded in 1912, Tennessee State University (TSU) is a comprehensive, urban, co-educational, HBCU in Nashville, Tennessee. TSU is recognized by the Carnegie Foundation for the Advancement of Teachers as an R3 Doctoral/Research University, a designation which highlights high quality research and graduate programs which serve the students, the state, the nation, and the world. TSU has been consistently listed in the U.S. News & World Report's "Guide to America's Best Colleges" for more than a decade. TSU offers 77 majors in eight undergraduate and graduate colleges and schools. TSU is engaged in scholarly research that covers biological science, chemical science, agricultural science, social science, engineering, physics; astronomy; health sciences; agriculture, consumer sciences, nursing, public service and urban affairs. TSU graduates the highest number of African-American bachelor degree holders in Agriculture, Agriculture Operations and Agriculture-related sciences. The University's sponsored research new awards for FY2016 exceeded \$54 million. TSU's outreach to other universities and agencies extends to local, regional, national, and global partnerships to produce the next generation of global researchers.

### Core Competencies: Astronomy/Astrophysics

TSU's Astronomy/Astrophysics Program within the Center of Excellence carries active research in the following areas.

- Spectroscopy of Binary and Multiple Stars with emphasis on solar-type close multiples and eclipsing binaries.
- Determination of Fundamental Stellar Properties, Lithium Abundances, and Evolutionary Status of Binaries.
- Combining Photometry and Spectroscopy of Eclipsing Binaries to determine masses, radii, and other fundamental properties. The results will be compared with evolutionary models.
- Determining orbital elements of symbiotic binaries and comparing periods with light variability periods.
- Astronomy Education – Variable Stars – Solar Type Stars – Galactic Halo.
- Comparison of algorithms for multi-period determination of variable stars.

- Understanding the effect of written course materials on demonstrated student learning.
- Automated Astronomy
- High Precision Photometry
- Solar-Type Stars
- Extrasolar Planets
- Extreme Stellar Magnetic Activity
- Surveys of Variable Stars
- Stellar Astrophysics
- Search for Extra-Terrestrial Life
- High Resolution Imaging Techniques

## **Core Competencies: Chemistry**

The Chemistry Department offers undergraduate programs (four different undergraduate curricula) leading to B.S. degrees and a graduate program (two graduate curricula) leading to an M.S. degree. The Master of Science (M.S.) degree is offered in two concentrations – Chemistry and Biochemistry. Research is conducted in all areas of Chemistry, especially in cancer, environmental science, nano-science, atmospheric chemistry, synthesis of molecules with biomedical interest, synthetic method development, and polymer science.

Current Funded Research topics include Cancer Research, Drug-drug Interactions and Synthesis of Biologically Active Compounds.

## **Core Competencies: Biology**

The research capabilities for the Department of Biological Sciences lie in the broad area of cell and molecular biology offered within M.S. in Biology and Ph.D. in Biological Science degree programs. Faculty research activities involve studies of plant extracts and the effect on cancer cell growth and function, studies of the role of D3 receptors in neuronal development, studies of collagen assembly and trafficking, studies of the role of the spectraplak protein, MACF1, in maintenance of brain tumors, studies of the use of microorganisms as bioinsecticides and as producers of antimicrobial and anticancer compounds, studies of inflammation cytokines in cancer biology, studies of genome variation in poultry and studies of global change ecology. TSU faculty serve as panelists and evaluators for federal and private organizations. They also actively work to address the problem of underrepresentation of minorities in science.

Current Funded Research topics include Global Change Ecology, Genome Variation in Poultry and Collagen IV Assembly and Trafficking.

## **Core Competencies: Engineering**

The College of Engineering faculty has been engaged in conducting research in many national and critical technology areas. Areas that are of interest are signal/image processing, bioinformatics, sensor fusion, applied intelligent systems, unmanned mobile robotics, and unmanned air vehicles, decision making processes, health monitoring (prognosis and diagnosis) of air craft engines, wireless communication, robust control systems, cyber-security, renewable energy sources, virtual reality. Additional faculty interests include high performance computing, chemical sensing detection systems.

Current Funded Research topics include Sensor Fusion, Battery technology, Health Monitoring, Wireless Communication and Networks, Decision Making using Robots, Helicopters, and RF Sensors, Cloud Computing Security, Smartphone security, Cyber Physical System security and Bioinformatics.

## **Past Performance**

- NIH-funded Minority Access to Research Careers (MARC) program. This program seeks to increase the number of highly-trained underrepresented biomedical and behavioral scientists in leadership positions.

- NSF-funded Historically Black Colleges and Universities-Undergraduate Program (HBCU-UP). The underlying purpose of the HBCU-UP is to develop pedagogies and methodologies for training undergraduates in the science, technology, engineering, and mathematics (STEM) areas. In addition, emphasis is placed on interdisciplinary enrichment of quantitative skills (mathematics and physics) of students in the sciences.
- Department of Education (Title III)
- United States Department of Agriculture (USDA)
- National Science Foundation (NSF).

## Facilities & Equipment

### Fairborn Observatory

- Six 0.4 to 0.8 meter Automatic Photoelectric Telescopes (APTs) – Precise stellar brightness measurements
- 0.36 meter Automatic Imaging Telescope (AIT) – Extrasolar planet search and public outreach
- 2-meter Automatic Spectroscopic Telescope (AST) and echelle spectrograph – High resolution stellar spectroscopy
- EXPERT III – Fiber fed echelle spectrograph for precision radial velocities
- VISION – Optical beam combiner for Navy Prototype Optical Interferometer at Lowell Observatory
- Optics Lab
- Cloud Computing Testbed
- Cyberphysical System Testbed
- Mobile Testbed
- CAVE: A room-sized Advanced Scientific Visualization Lab

## Institutional Partners – U.S.

Harvard-Smithsonian Center for Astrophysics  
 National Center for Atmospheric Research, Boulder  
 California Institute of Technology, Pasadena  
 Carnegie Institute of Washington  
 Princeton University  
 Cornell University  
 Yale University  
 San Francisco State University  
 Catholic University of America, Baltimore  
 Pennsylvania State University  
 Georgia State University  
 Central Michigan University, Mt. Pleasant  
 Indiana University  
 Institute for Astronomy, University of Hawaii  
 Johns Hopkins University Applied Physics Lab  
 Kitt Peak National Observatory  
 Lowell Observatory, Flagstaff  
 Massachusetts Institute of Technology  
 McDonald Observatory, University of Texas  
 Northwestern University, Evanston  
 Ohio Wesleyan University, Delaware  
 University of California, Los Angeles  
 Space Telescope Science Institute

Swarthmore College  
 University of California, Santa Cruz  
 University of Arizona, Tucson  
 University of Florida, Gainesville  
 University of Maryland, College Park  
 University of Michigan  
 University of North Carolina  
 Chungbuk National University, Korea

## Institutional Partners – International

Astronomical Institute of Potsdam  
 Astronomical Institute of the Slovak Academy of Science  
 Centro de Astrobiologia, Madrid  
 European Southern Observatory  
 Finnish Center for Astronomy  
 Herzberg Institute of Astrophysics  
 Sternberg Astronomical Institute, Moscow  
 Australian National University  
 Institut d'Astrophysique de Paris  
 Institute for Astronomy, Vienna  
 University of British Columbia, Vancouver  
 Polish Academy of Sciences, Torun  
 University of Toronto