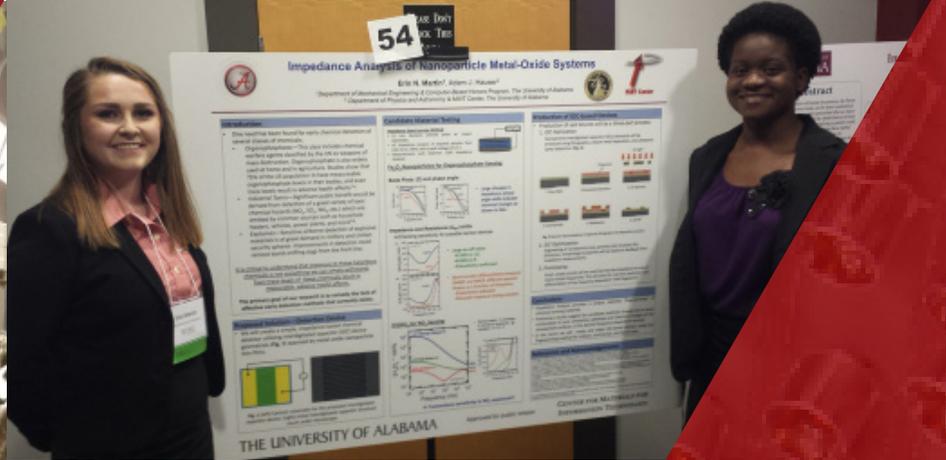
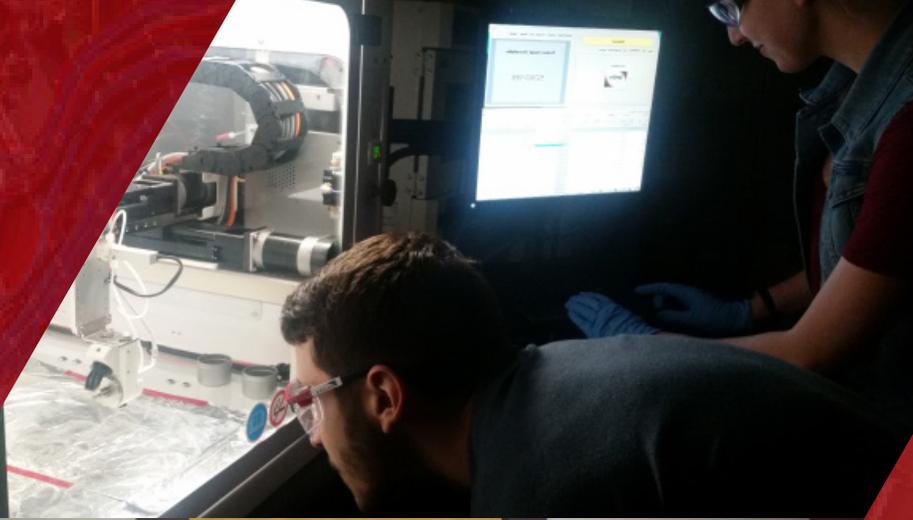


PHYSICS & ASTRONOMY

Graduate Program



EXCELLENCE IN THE 21ST CENTURY

Physics and Astronomy at The University of Alabama

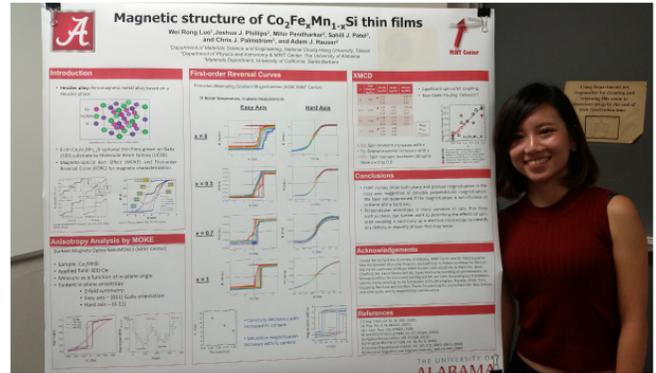
With active research programs in a wide range of specialties, world class facilities, and young, energetic faculty, the graduate program at The University of Alabama is dedicated to helping you realize your potential.

The Department of Physics and Astronomy at The University of Alabama provides exciting opportunities for students to work on cutting-edge research with internationally-renowned scholars, and receive the intensive preparation required for today's top positions in industry and academia.

Over the last 10 years, we have recruited over 14 new faculty members, each a world-class researcher in their own right. This rapid growth has resulted in a young, vibrant faculty focused on bringing world-class research and training to their graduate students.

State-of-the-art research laboratories are augmented by user facilities across campus and dedicated clean rooms, analytical, and machine shop staff to assist and train researchers in the latest techniques and equipment.

We offer doctor of philosophy (PhD) and master of science (MS) degrees in physics, with the option of specialization in astronomy. While we offer a course-only MS, our graduate program is primarily focused on research.



Research toward a degree may be conducted in either experimental or theoretical areas. Fields of strength at UA include astronomy and astrophysics, condensed matter, precision timing, elementary particles, high energy and particle physics.

Our department is fully committed to the success of our graduate students. All students admitted to the graduate program are fully supported financially by either teaching assistantships, research assistantships, or fellowships.

For more information on applying, or if you would like to set up a visit, please contact the graduate admissions director at physgrad@ua.edu.



PHYSICS AND ASTRONOMY:

A core research strength at The University of Alabama



State-of-the-art user facilities and access to national research laboratories complement our faculty members' world-class group laboratories.

Although there is significant collaboration across borders, research is nominally broken down into either experimental or theoretical groups. Experimental strengths include magnetic materials, high-energy physics, materials science, extragalactic astronomy, and particle astrophysics. Theoretical programs include condensed matter, elementary particles, atomic and molecular physics, extragalactic astronomy, astrophysics, and particle astrophysics.

Observational and theoretical astronomy research programs include planet formation, galaxy interactions and morphology, active galaxies and quasars, galaxy and gas dynamics in clusters of galaxies, thermonuclear supernovae, and the cosmological distance scale. Faculty and students use national observatories, the Hubble Space Telescope, and various satellites to collect data.

Experimental and theoretical condensed matter includes cutting-edge interdisciplinary research at the Alabama Collaborative for Materials Exploration (ACME), and frequent trips to Argonne, Brookhaven, and Oak Ridge National Laboratories. Research at UA focuses on nanometer scale science and technology, magnetic materials, and devices for information storage. This includes spin electronics, novel strategies for information storage, and the theoretical and experimental study of the electronic and magnetic properties of novel materials.

Particle astrophysics uses fundamental particles to explore some of the most extreme objects in the universe, and uses astronomical signals to push the boundaries of particle physics. Experimental activities center on the IceCube Neutrino Observatory at the South Pole, and theoretical activities

focus on the phenomenological aspects of new physics beyond the Standard Model such as supersymmetry, extra dimensions and Grand Unified Theories.

Theoretical particle and nuclear physics research is being pursued by a group of 4 faculty members and currently 7 graduate students. The research projects being carried out by the faculty include both individual projects and joint projects within the group. The individual projects are in the areas of phenomenology, cosmology, holography (gauge/gravity correspondence), and matrix models of physical systems. The joint projects within the group involve topics such as application of holographic methods, topological solitons, the quark-gluon plasma, and the universe shortly after the big bang.”

Experimental nuclear and particle physics researchers at UA collaborate on international experiments that seek to answer some of the most fundamental questions in particle physics. We are involved in: searches for new physics beyond the Standard Model at the energy frontier with the CMS experiment at CERN's Large Hadron Collider; direct Dark Matter detection with the LZ experiment; searches for magnetic monopoles with the MoEDAL experiment at CERN; and an attempt to understand the nature of the neutrino by searching for neutrinoless double beta decay with the EXO-200 and nEXO experiments. These activities involve collaboration with institutions and laboratories across the world, and include travel to the sites of our projects in Switzerland, South Dakota, and New Mexico. Facilities within the group include a state of the art radiation detection lab, cleanroom labs for preparing samples for trace (ppt) analysis, and a full set of tools and instruments for developing and characterizing devices for detector calibration.

MEET OUR FACULTY

>\$5 Million Grants and Research Expenditures, 2021

5 Young Investigator Awards, 2014-2021

>50% of faculty hired in the last 10 years

ASTRONOMY

Jimmy Irwin, PhD, University of Virginia
Preethi Nair, PhD, University of Toronto
Raymond E. White, PhD, University of Virginia

ASTROPHYSICS

Jeremy Bailin, PhD, University of Arizona
Dean Townsley, PhD, UC Santa Barbara
Chao-Chin Yang, PhD, University of Illinois

AMO PRECISION TIMING

Thejesh Bandi, PhD, University of Neuchatel

CONDENSED MATTER THEORY

Georg Schwiete, PhD, Ruhr University Bochum
Wang-Kong Tse, PhD, Maryland University

CONDENSED MATTER EXPERIMENT

Paulo Araujo, PhD, Federal University of Minas Gerais
Adam Hauser, PhD, The Ohio State University
Patrick LeClair, PhD, Eindhoven University
Tim Mewes, PhD, University of Kaiserslautern
Rainer Schad, PhD, University Hannover

PARTICLE ASTROPHYSICS EXPERIMENT

Marcos Santander, PhD, University of Wisconsin-Madison
Dawn R. Williams, PhD, UC Los Angeles

PARTICLE PHYSICS EXPERIMENT

Sergei Gleyzer, PhD, Florida State University
Igor Ostrovskiy, PhD, University of Alabama
Andreas Piepke, PhD, Ruprecht Karls University
Paolo Rumerio, PhD, Northwestern University
Ion Stancu, PhD, Rice University
Emanuele Usai, PhD, University of Hamburg
Juijen Wang, PhD, University of New Mexico

PARTICLE PHYSICS THEORY

Benjamin C. Harms, PhD, Florida State University
Matthias Kaminski, PhD, LMU Munich
Nobuchika Okada, PhD, Tokyo Metropolitan
Allen Stern, PhD, Syracuse University

FACULTY SPOTLIGHTS

Dr. Thejesh Bandi researches atomic clocks - precision timing and navigation, which bridges the basic science of Physics with the niche technologies of Engineering. His experiences in space science and technologies from the three major space agencies - National Aeronautics and Space Administration (NASA), the European Space Agency (ESA) and the Indian Space Research Organisation (ISRO), spanning more than a decade has helped towards the establishment of the UA Precision Navigation, Timing and Frequency (PNTF) Lab. Students receive training and hands-on research opportunities, especially focused on the next-Gen portable robust clocks and related technologies, alternative safe-GNSS methods, AI-methods in PNT and the building of precision timescales.



Dr. Sergei Gleyzer is focused on searches for physics beyond the Standard Model with the Large Hadron Collider (LHC) at CERN. In particular, Dr. Gleyzer works on the development of artificial intelligence techniques for new physics, including searches for rare decays of the Higgs boson and dark matter using the data collected by the Compact Muon Solenoid (CMS) experiment. Dr. Gleyzer also contributes to the development of machine learning techniques for the High-Granularity Calorimeter for the CMS Endcap and the High luminosity LHC project. In addition to the LHC CMS collaboration, Dr. Gleyzer is a member of the Vera Rubin Observatory LSST Strong Lensing Science Collaboration. Dr. Gleyzer is a recipient of UA's 2022-2025 Distinguished Teaching with Technology Fellowship. He is also the founder of the Machine Learning for Science (ML4SCI) Foundation and the ML4SCI Google Summer of Code program.



COURSEWORK

The graduate program at UA provides a deep foundation in physics and mathematics, as well as specialized offerings on research-level special topics and advanced techniques.

The Department of Physics and Astronomy offers the doctor of philosophy (PhD) and master of science (MS) degrees in physics, with the option of specialization in astronomy. Although we offer a course-only MS, our graduate program is mostly oriented toward current physics research. Experimental programs include magnetic materials, high-energy physics, materials science, observational extragalactic astronomy, and particle astrophysics. Theoretical programs include condensed matter, elementary particles, atomic and molecular physics, extragalactic astronomy, astrophysics, and particle astrophysics.

Physics graduate students begin by taking core physics courses in Classical Mechanics, Electromagnetism, Quantum Mechanics, and Statistical Physics. Astronomy students typically substitute a course in Radiative Processes for the second semester of Electromagnetism, and take Theoretical Astrophysics instead of Quantum Mechanics II. Students also take at least four elective courses in their chosen broad area of research.

Students receive formal and informal instruction through classwork and laboratory instruction from faculty, postdoctoral scholars, and research scientists. All students admitted to the graduate program are fully supported financially by either teaching assistantships, research assistantships, or fellowships.

EXAMPLE COURSE SCHEDULES

Astronomy

FIRST YEAR

FALL SEMESTER:

- Classical Mechanics
- Electromagnetic Theory I
- Theoretical Astrophysics

SPRING SEMESTER:

- Quantum Mechanics I
- Statistical Physics
- Radiative Processes

SECOND YEAR

FALL SEMESTER:

- Stars and Stellar Evolution
- Galaxy and Stellar Dynamics

SPRING SEMESTER:

- Observational Techniques
- Extragalactic Astrophysics

Condensed Matter

FIRST YEAR

FALL SEMESTER:

- Classical Mechanics
- Electromagnetic Theory I

SPRING SEMESTER:

- Quantum Mechanics I
- Electromagnetic Theory II
- Statistical Physics

SECOND YEAR

FALL SEMESTER:

- Quantum Mechanics II
- Magnetism and Magnetic Materials
- Advanced Laboratory

SPRING SEMESTER:

- Solid State Physics
- Advanced Magnetic Phenomena
- Research Techniques

Nuclear & Particle Physics

FIRST YEAR

FALL SEMESTER:

- Classical Mechanics
- Electromagnetic Theory I

SPRING SEMESTER:

- Quantum Mechanics I
- Electromagnetic Theory II
- Statistical Physics

SECOND YEAR

FALL SEMESTER:

- Quantum Mechanics II
- Nuclear and Particle Physics
- Relativity

SPRING SEMESTER:

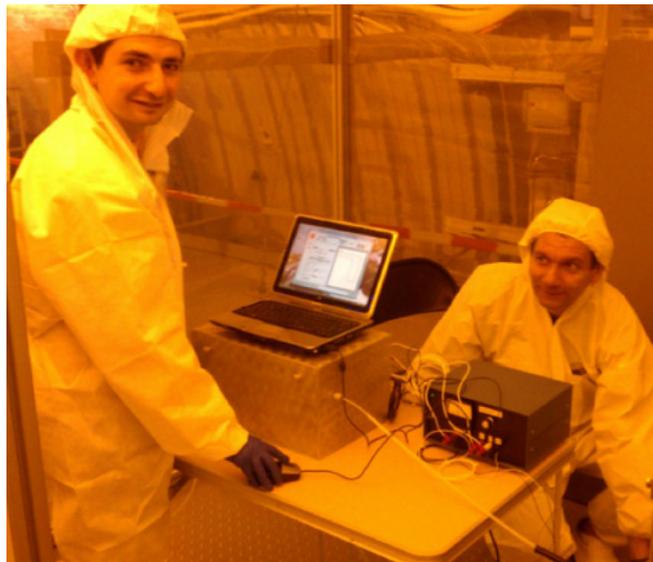
- Quantum Field Theory
- Machine Learning
- Advanced Laboratory

DEPARTMENTAL STATISTICS

Admission Requirements

GRE scores are not required.
PGRE scores are not required.

For applicants whose first language is not English, we require a TOEFL score of at least 550 on the paper-based test (PBT) or 213 on the computer-based test (CBT) or 79 on the internet-based test (iBT) or an IELTS score of at least 6.5 or a score of 105 on the Duolingo English test; these scores need to be less than two years old at the time of enrollment. If you have received a degree from a U.S. institution within three years of the time of enrollment, a TOEFL score is not necessary. International students from some English speaking countries may not be required to submit English language test scores. The list of countries is given on the University of Alabama Graduate School Admissions webpage.



Graduate Class Averages

Average undergrad GPA: 3.6 (3.0 - 3.9) — on 4.0 point scale.

For international/transfer students:

Average graduate MS GPA: 3.7 (3.4 - 3.9)

Grad MS percentage: > 70%

Average GRE general score: 319 (304 - 335)*

Average GRE quant percentile: 85% (47% - 97%)*

*Scores are no longer required.

Average PGRE score: 830 (660 - 990)**

Average PGRE percentile: 73% (42% - 94%)

**Physics GRE scores are not required but can be submitted.



GRADUATE FAQ



1. What factors are important in securing a graduate position at UA?

Graduate admission decisions are based on your entire application package. Some specific criteria include:

- Proficiency (A to B average) in undergraduate physics, especially upper-level physics courses.
- Previous research experience, conference presentations, and journal publications are looked upon very favorably.
- Reference letters by research advisors and upper-level physics instructors are very important.
- A statement of purpose that shows familiarity with research areas and potential faculty advisers.
- While the Physics GRE is not required, note that a score above 70th percentile will waive the PhD qualifying exam requirement.

2. What is the due date for applications?

In order to be considered for university fellowships, all application materials should be received by December 15. To receive full consideration for departmental support via graduate teaching or research assistantships, all application materials should be received by January 15.

3. How are graduate students supported financially?

Financial support is available for PhD students in good academic standing either through teaching assistantships, research assistantships, or fellowships. Graduate students who are supported by an assistantship or a fellowship also receive tuition and health insurance. Students are also strongly encouraged to apply for external graduate fellowships. Further details on financial support can be found at the webpage:

<https://physics.ua.edu/graduate-program/teaching-and-research-assistantships/>

4. What are my prospects after graduation?

Students who graduate with an MS or PhD in Physics/Astronomy from UA have moved into multiple career paths, including academia, national labs, industry, teaching, as well as Non-STEM fields. Please visit our Alumni page for information on career paths taken by our recent graduates: <https://physics.ua.edu/alumni-directory/>

More information available here: <https://physics.ua.edu/graduate-program/graduate-admissions/>

TUSCALOOSA: A HIDDEN GEM

Boasting a low cost of living and a small-town feel, Tuscaloosa also offers big-city amenities, a vibrant nightlife, concerts and art events, and scenic outdoor recreation.



In recent years, Tuscaloosa has been named the “Most Liveable City in America,” one of America’s “100 Best Communities for Young People,” one of the “50 Best College Towns,” and one of the “Best Places to Launch a Small Business.”

FINANCIAL SUPPORT

The University of Alabama offers highly competitive fellowships, assistantships, and scholarship support to our 4500+ graduate and professional students.

More information is available at

<https://physics.ua.edu/graduate-program/financial-support/>



GRADUATE TEACHING ASSISTANTSHIPS (GTA)

Graduate Teaching Assistants typically lead laboratory class sections, grade coursework, provide tutoring, and lead lectures for 12-15 hours/week. The standard physics stipend rate is \$2,230/mo for the 9 month academic year. First year students are guaranteed summer TA support at the same rate. In subsequent years, partial or full summer support is available via TAs or research assistantships.

GRADUATE COUNCIL FELLOWSHIPS

The graduate council fellowship covers full tuition and benefits without teaching duties for (a) year 1 for regular fellowships and (b) for years 1, 3, and 5 for capstone fellowships. The stipend ranges from \$2,230/month to ~\$2,666/month for 12 months during fellowship years. Students are supported by a regular GTA in non-fellowship years.

DAVID A. FRANKO FELLOWSHIP

A special elite subsection of the Graduate Council Fellowship, the Franko fellowship gives a stipend of \$25,000/year for up to five years plus a full tuition scholarship and benefits, with an added supplement of \$4,000/year (for a total of \$29,000/year) in years 1 - 4. Including summer support, the total fellowship is worth ~\$38,666/year.

MCNAIR GRADUATE SCHOLARSHIP

A full tuition scholarship for underrepresented minority or first-time college applicants. The stipend ranges from \$2,230/month to ~\$2,666/month during fellowship years (1, 2, or 3 years). Those who have completed a Ronald E. McNair Post-Baccalaureate Achievement Program at any US university may qualify for a full tuition scholarship for the duration of their program.

NATIONAL ALUMNI ASSOCIATION FELLOWSHIP

The national alumni association fellowship covers tuition and benefits without teaching duties for 1 year. The stipend is the same as the GTA rate. Applicants must be residents of the State of Alabama. Nominations are made through the prospective/current program. For more information, contact Kathleen Nodine at knodine@ua.edu.

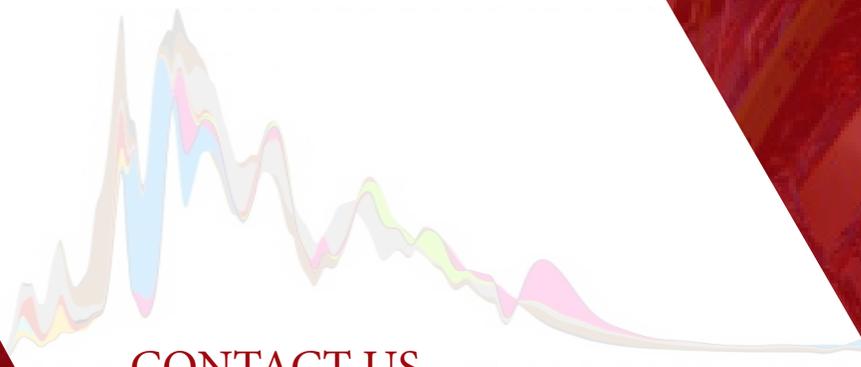
RESIDENTIAL/TUTWILER/MERIT SCHOLARS

Presidential Scholars, Tutwiler Scholars, or National Merit/National Achievement Finalists who graduate early and have not used all of their scholarship benefit during their undergraduate program may apply any remaining tuition benefit to a graduate program at The University of Alabama.

JOINT FACULTY DEVELOPMENT FELLOWSHIP

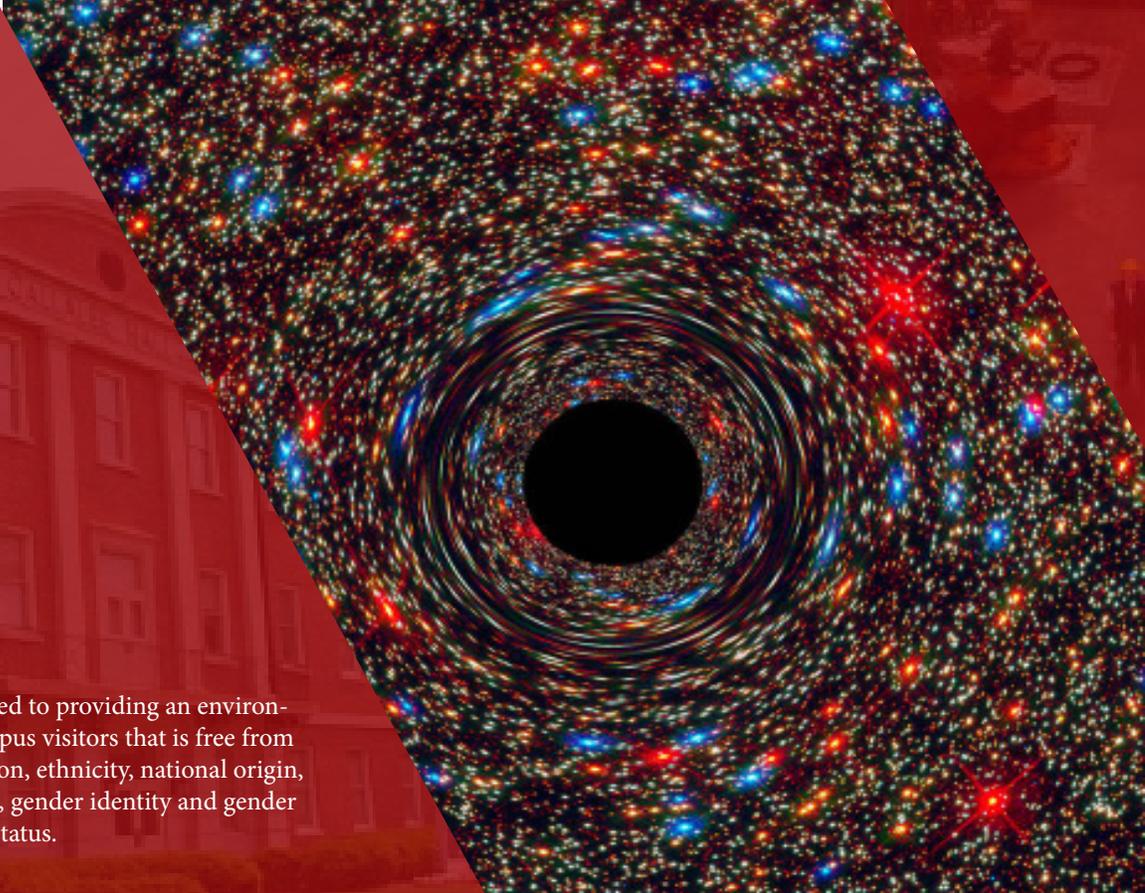
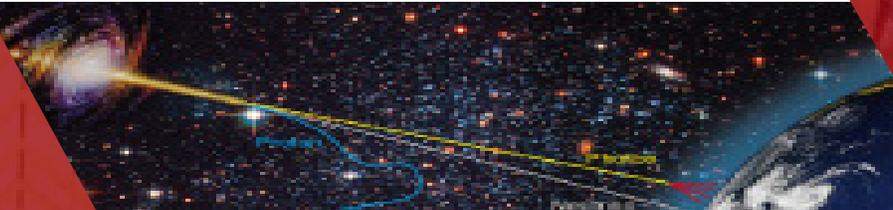
Alabama A&M University, Alabama State University, Oakwood College, and Stillman College faculty who do not have a terminal degree in their field of instruction can be nominated for this fellowship by their home institution.





CONTACT US

Department of Physics and Astronomy
physgrad@ua.edu | physics.ua.edu | (205) 348-5050



The University of Alabama is committed to providing an environment for employees, students and campus visitors that is free from harassment based on race, color, religion, ethnicity, national origin, sex (which includes sexual orientation, gender identity and gender expression), age, disability or veteran status.