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STUDENT UNDERGRADUATE RESEARCH FELLOWSHIP

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Residency Requirements

SURF Residency Requirements:

- U.S. Citizens, resident aliens, or nationals

Honors College Research Grant (HCRG) and Office of Undergraduate Research Grant (OURG)

Residency Requirements:

- Anyone **including** international students

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Eligibility Requirements

	SURF	HCRG	OURG
GPA	3.25	3.5*	3.5
Credits	30	30	30
Honors Credits		6	

*required GPA may be different for some WCOB and FJAD students, check with your Honors Program or Dr. Jennie Popp

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Credit load requirements during funding period

	SURF	HCRG	OURG
Spring	12	12*	12*
Summer	6	6*	6*
Fall	12	12*	12*

*Exceptions made for graduating Seniors

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SURF Registration

Registration can be found on our website at awards.uark.edu/surf

QR Code at the end

Register Here

- You and your mentor will receive confirmation emails once you submit your registration.
- You will receive a link to download the **SURF Toolkit** containing all documentation needed to apply.
- Registration allows us to keep you updated with important information and changes.

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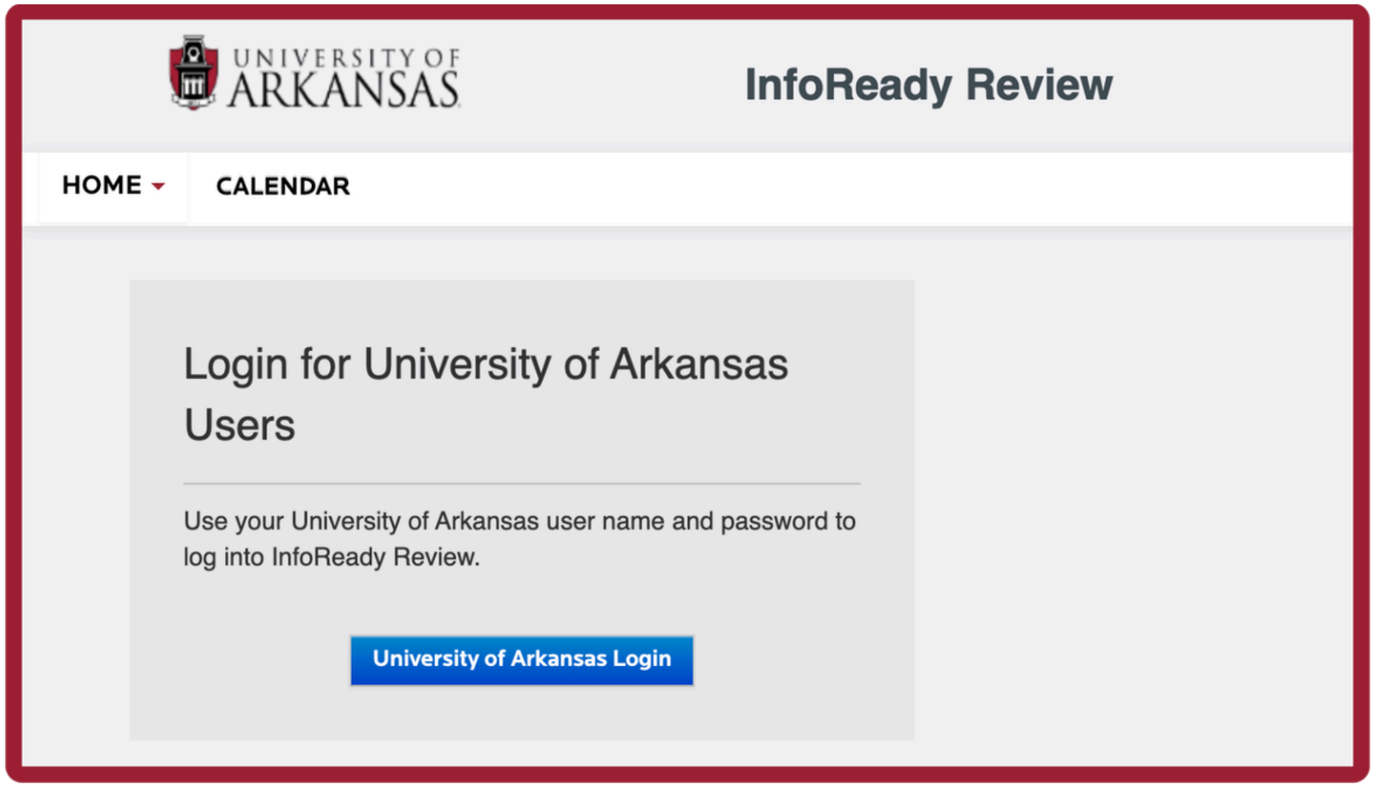
InfoReady Application

Make certain you are using your **personal** UARK login information



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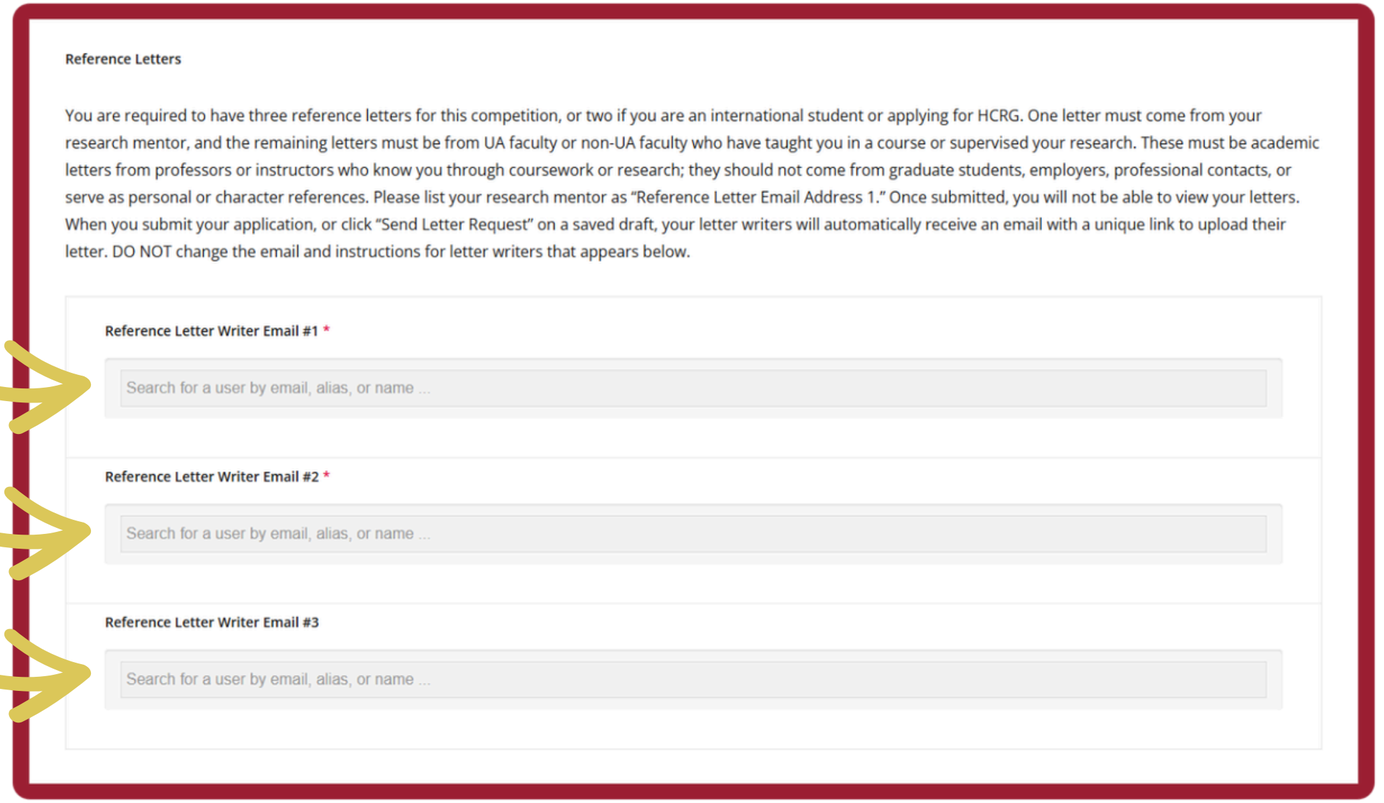
*Once into InfoReady, skip to the end of the application to fill in your letter writers.

Mentor - Letter Writer #1

1

Letter Writer #2

Letter Writer #3



2

Save as Draft

Send Reference Letter Request

3

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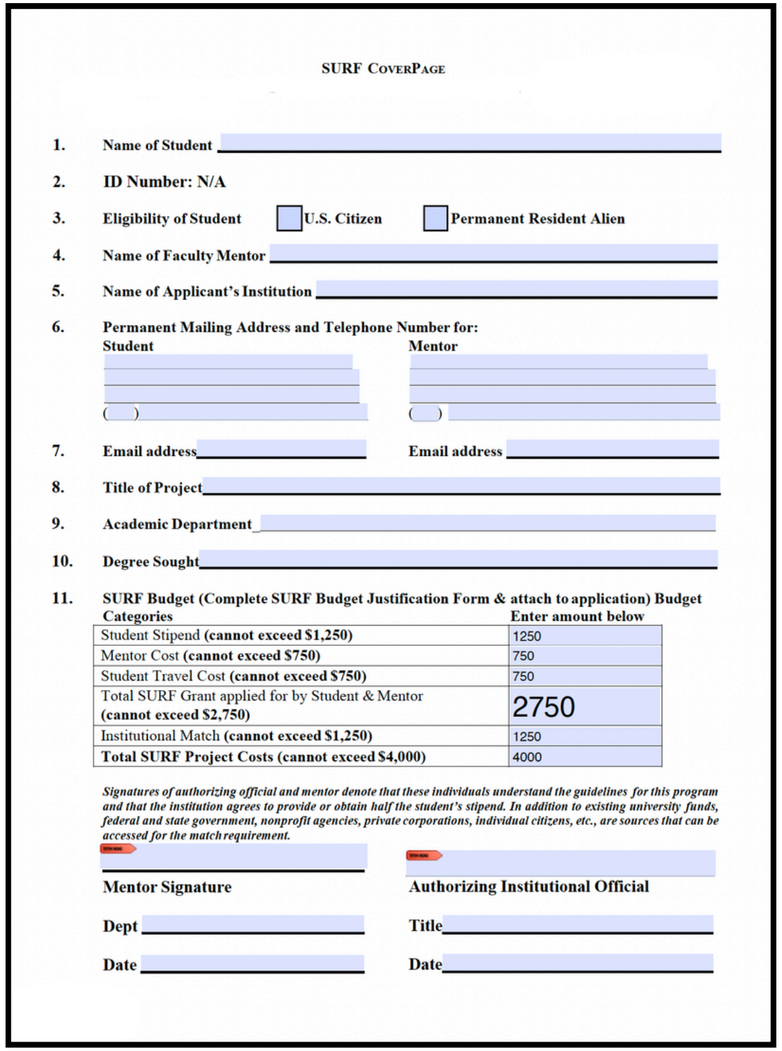
SURF Cover Page

- This is an ADHE form
- Can be physically or digitally signed



SURF CoverPage

1. Name of Student _____
2. ID Number: N/A
3. Eligibility of Student ☐ U.S. Citizen ☐ Permanent Resident Alien
4. Name of Faculty Mentor _____
5. Name of Applicant's Institution _____
6. Permanent Mailing Address and Telephone Number for:
   Student: _____ ( )
   Mentor: _____ ( )
7. Email address _____ Email address _____
8. Title of Project _____
9. Academic Department _____
10. Degree Sought _____
11. SURF Budget (Complete SURF Budget Justification Form & attach to application) Budget

Categories	Enter amount below
Student Stipend **(cannot exceed $1,250)**	1250
Mentor Cost **(cannot exceed $750)**	750
Student Travel Cost **(cannot exceed $750)**	750
Total SURF Grant applied for by Student & Mentor **(cannot exceed $2,750)**	2750
Institutional Match **(cannot exceed $1,250)**	1250
Total SURF Project Costs (cannot exceed $4,000)	4000

Signatures of authorizing official and mentor denote that these individuals understand the guidelines for this program and that the institution agrees to provide or obtain half the student's stipend. In addition to existing university funds, federal and state government, nonprofit agencies, private corporations, individual citizens, etc., are sources that can be accessed for the match requirement.

Mentor Signature — Authorizing Institutional Official

Dept _____ Title _____

Date _____ Date _____

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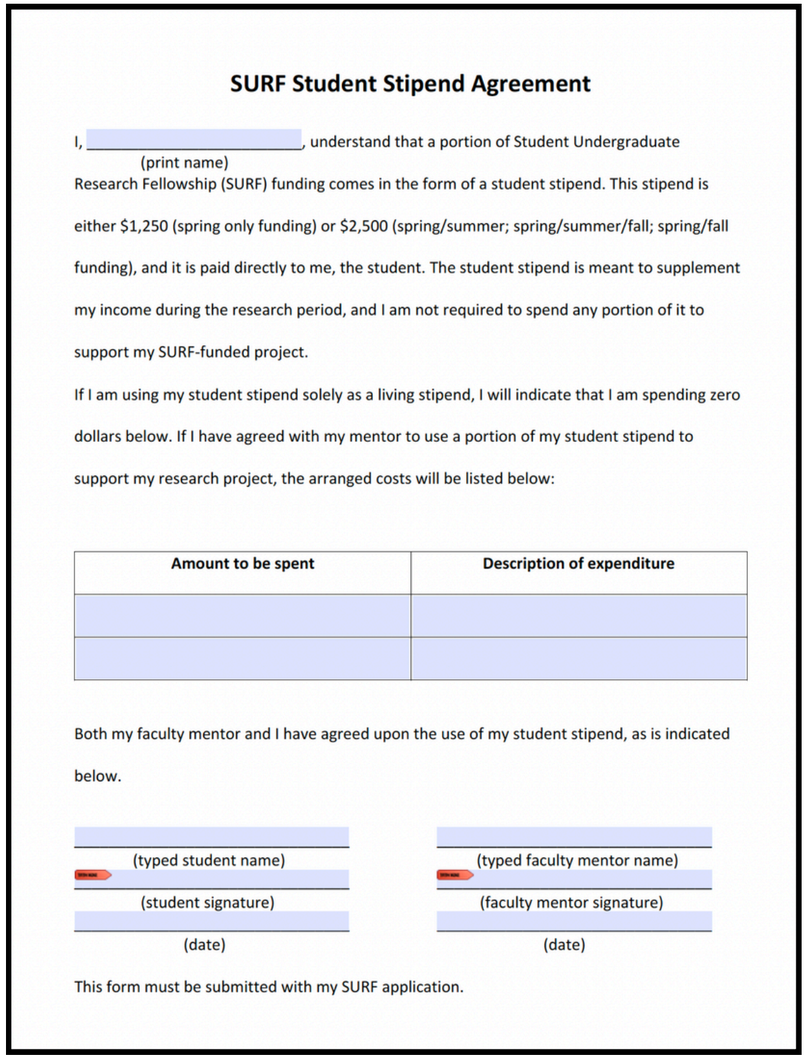
SURF Student Stipend Agreement

- This is a UARK form
- Every applicant fills this out
- SURF funds you as a researcher, but you may want to use some funds to supplement your research expenses
- Can be physically or digitally signed



SURF Student Stipend Agreement

I, _____, understand that a portion of Student Undergraduate
(print name)
Research Fellowship (SURF) funding comes in the form of a student stipend. This stipend is either $1,250 (spring only funding) or $2,500 (spring/summer; spring/summer/fall; spring/fall funding), and it is paid directly to me, the student. The student stipend is meant to supplement my income during the research period, and I am not required to spend any portion of it to support my SURF-funded project.

If I am using my student stipend solely as a living stipend, I will indicate that I am spending zero dollars below. If I have agreed with my mentor to use a portion of my student stipend to support my research project, the arranged costs will be listed below:

Amount to be spent	Description of expenditure

Both my faculty mentor and I have agreed upon the use of my student stipend, as is indicated below.

(typed student name)

(student signature)

(date)

(typed faculty mentor name)

(faculty mentor signature)

(date)

This form must be submitted with my SURF application.

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Don’t do this

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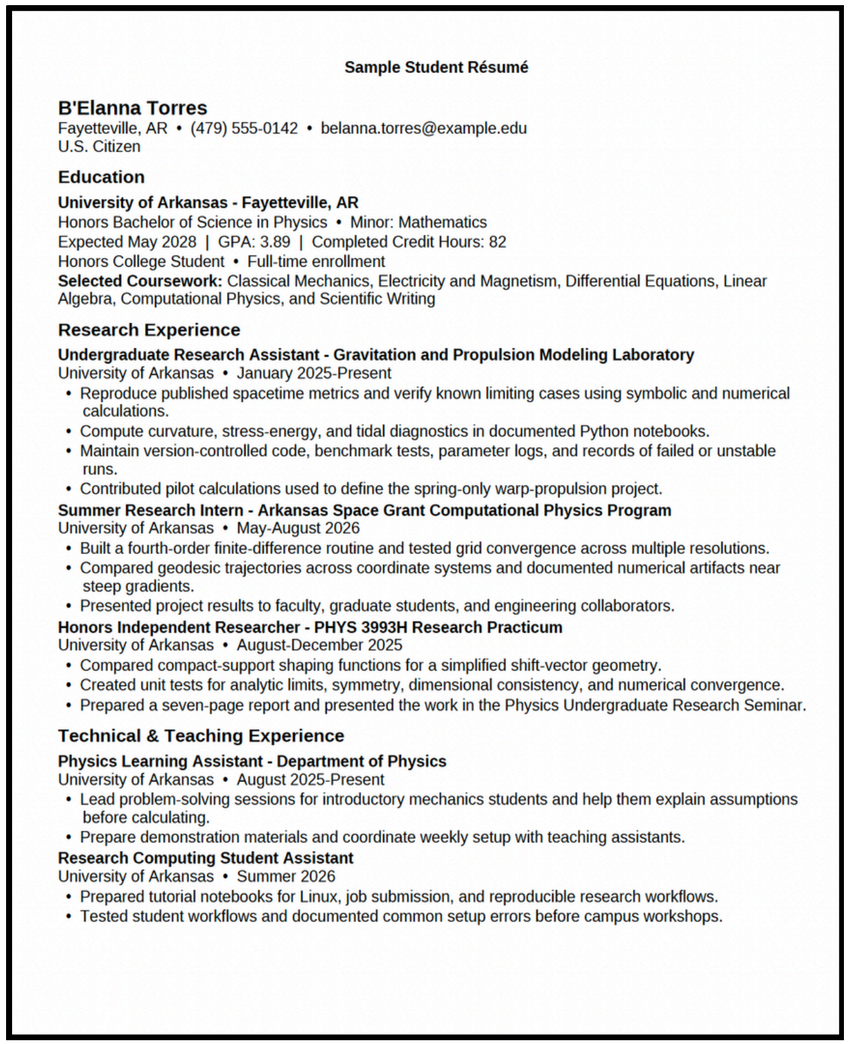
Academic Resume

- **Two pages**
- Sections are adjustable but you should begin with education then any research experience



Sample Student Résumé

B'Elanna Torres
Fayetteville, AR • (479) 555-0142 • belanna.torres@example.edu
U.S. Citizen

Education

University of Arkansas - Fayetteville, AR
Honors Bachelor of Science in Physics • Minor: Mathematics
Expected May 2028 | GPA: 3.89 | Completed Credit Hours: 82
Honors College Student • Full-time enrollment
Selected Coursework: Classical Mechanics, Electricity and Magnetism, Differential Equations, Linear Algebra, Computational Physics, and Scientific Writing

Research Experience

Undergraduate Research Assistant - Gravitation and Propulsion Modeling Laboratory
University of Arkansas • January 2025-Present
- Reproduce published spacetime metrics and verify known limiting cases using symbolic and numerical calculations.
- Compute curvature, stress-energy, and tidal diagnostics in documented Python notebooks.
- Maintain version-controlled code, benchmark tests, parameter logs, and records of failed or unstable runs.
- Contributed pilot calculations used to define the spring-only warp-propulsion project.

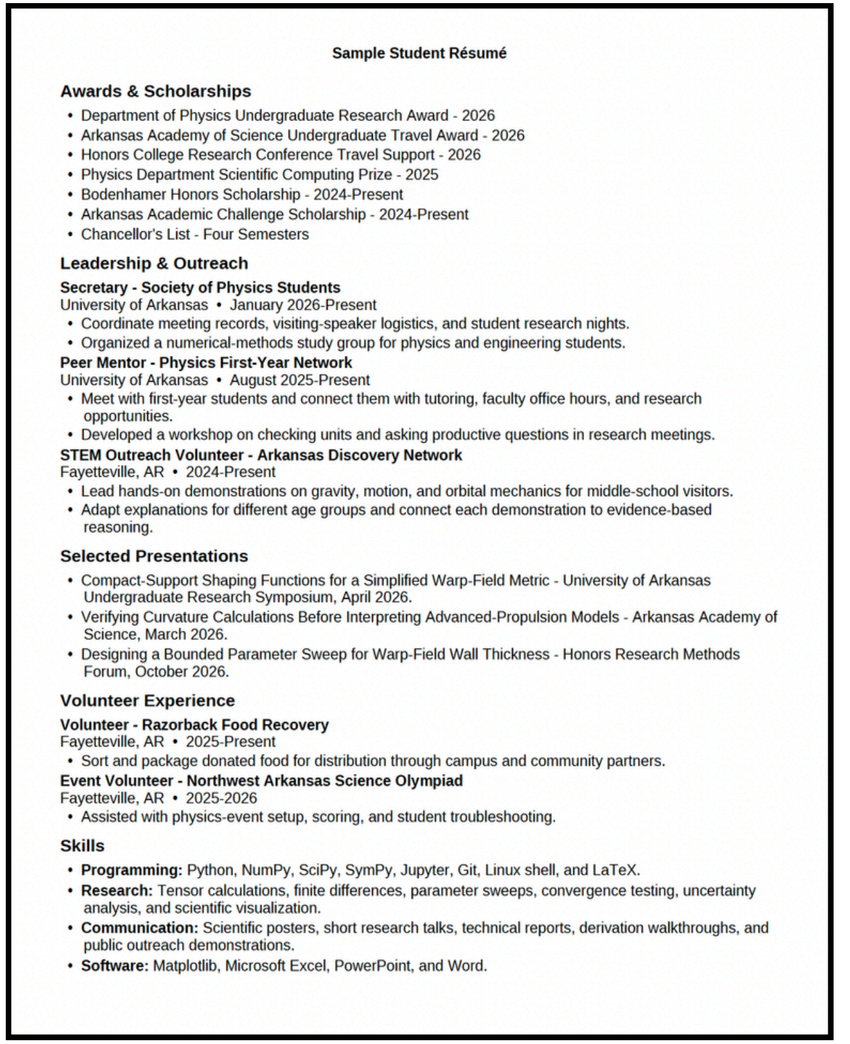
Summer Research Intern - Arkansas Space Grant Computational Physics Program
University of Arkansas • May-August 2026
- Built a fourth-order finite-difference routine and tested grid convergence across multiple resolutions.
- Compared geodesic trajectories across coordinate systems and documented numerical artifacts near steep gradients.
- Presented project results to faculty, graduate students, and engineering collaborators.

Honors Independent Researcher - PHYS 3993H Research Practicum
University of Arkansas • August-December 2025
- Compared compact-support shaping functions for a simplified shift-vector geometry.
- Created unit tests for analytic limits, symmetry, dimensional consistency, and numerical convergence.
- Prepared a seven-page report and presented the work in the Physics Undergraduate Research Seminar.

Technical & Teaching Experience

Physics Learning Assistant - Department of Physics
University of Arkansas • August 2025-Present
- Lead problem-solving sessions for introductory mechanics students and help them explain assumptions before calculating.
- Prepare demonstration materials and coordinate weekly setup with teaching assistants.

Research Computing Student Assistant
University of Arkansas • Summer 2026
- Prepared tutorial notebooks for Linux, job submission, and reproducible research workflows.
- Tested student workflows and documented common setup errors before campus workshops.



Sample Student Résumé

Awards & Scholarships

- Department of Physics Undergraduate Research Award - 2026
- Arkansas Academy of Science Undergraduate Travel Award - 2026
- Honors College Research Conference Travel Support - 2026
- Physics Department Scientific Computing Prize - 2025
- Bodenhamer Honors Scholarship - 2024-Present
- Arkansas Academic Challenge Scholarship - 2024-Present
- Chancellor's List - Four Semesters

Leadership & Outreach

Secretary - Society of Physics Students
University of Arkansas • January 2026-Present
- Coordinate meeting records, visiting-speaker logistics, and student research nights.
- Organized a numerical-methods study group for physics and engineering students.

Peer Mentor - Physics First-Year Network
University of Arkansas • August 2025-Present
- Meet with first-year students and connect them with tutoring, faculty office hours, and research opportunities.
- Developed a workshop on checking units and asking productive questions in research meetings.

STEM Outreach Volunteer - Arkansas Discovery Network
Fayetteville, AR • 2024-Present
- Lead hands-on demonstrations on gravity, motion, and orbital mechanics for middle-school visitors.
- Adapt explanations for different age groups and connect each demonstration to evidence-based reasoning.

Selected Presentations

- Compact-Support Shaping Functions for a Simplified Warp-Field Metric - University of Arkansas Undergraduate Research Symposium, April 2026.
- Verifying Curvature Calculations Before Interpreting Advanced-Propulsion Models - Arkansas Academy of Science, March 2026.
- Designing a Bounded Parameter Sweep for Warp-Field Wall Thickness - Honors Research Methods Forum, October 2026.

Volunteer Experience

Volunteer - Razorback Food Recovery
Fayetteville, AR • 2025-Present
- Sort and package donated food for distribution through campus and community partners.

Event Volunteer - Northwest Arkansas Science Olympiad
Fayetteville, AR • 2025-2026
- Assisted with physics-event setup, scoring, and student troubleshooting.

Skills

- **Programming:** Python, NumPy, SciPy, SymPy, Jupyter, Git, Linux shell, and LaTeX.
- **Research:** Tensor calculations, finite differences, parameter sweeps, convergence testing, uncertainty analysis, and scientific visualization.
- **Communication:** Scientific posters, short research talks, technical reports, derivation walkthroughs, and public outreach demonstrations.
- **Software:** Matplotlib, Microsoft Excel, PowerPoint, and Word.

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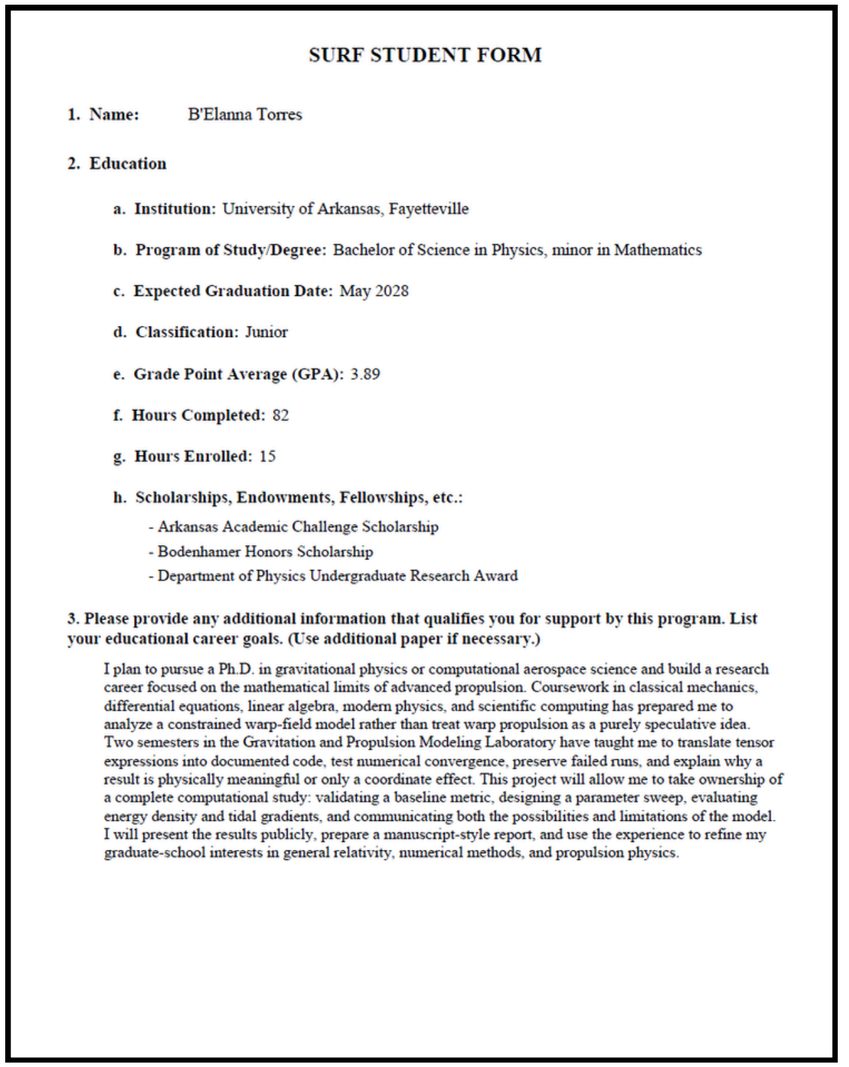
Student Form

- **Two-page maximum**
- Include a few sentences about your educational and career goals



SURF STUDENT FORM

1. Name: B'Elanna Torres

2. Education

a. **Institution:** University of Arkansas, Fayetteville

b. **Program of Study/Degree:** Bachelor of Science in Physics, minor in Mathematics

c. **Expected Graduation Date:** May 2028

d. **Classification:** Junior

e. **Grade Point Average (GPA):** 3.89

f. **Hours Completed:** 82

g. **Hours Enrolled:** 15

h. **Scholarships, Endowments, Fellowships, etc.:**

- Arkansas Academic Challenge Scholarship
- Bodenhamer Honors Scholarship
- Department of Physics Undergraduate Research Award

3. Please provide any additional information that qualifies you for support by this program. List your educational career goals. (Use additional paper if necessary.)

I plan to pursue a Ph.D. in gravitational physics or computational aerospace science and build a research career focused on the mathematical limits of advanced propulsion. Coursework in classical mechanics, differential equations, linear algebra, modern physics, and scientific computing has prepared me to analyze a constrained warp-field model rather than treat warp propulsion as a purely speculative idea. Two semesters in the Gravitation and Propulsion Modeling Laboratory have taught me to translate tensor expressions into documented code, test numerical convergence, preserve failed runs, and explain why a result is physically meaningful or only a coordinate effect. This project will allow me to take ownership of a complete computational study: validating a baseline metric, designing a parameter sweep, evaluating energy density and tidal gradients, and communicating both the possibilities and limitations of the model. I will present the results publicly, prepare a manuscript-style report, and use the experience to refine my graduate-school interests in general relativity, numerical methods, and propulsion physics.

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Project Summary

- **One page**
- Think of this as a scholarly abstract
- Can be either single- or double-spaced
- Be sure to include: project title, student name, mentor name, school, classification, area of study, and GPA

Student: B'Elanna Torres
Mentor: Leah Brahms
Institution: University of Arkansas
Classification: Junior
Grade Point Average: 3.89
Program of Study/Degree: Bachelor of Science in Physics, minor in Mathematics
Title of Project: Computational Modeling of Warp-Field Geometry for Hypothetical Propulsion

Summary of Project

Warp propulsion can be framed as a testable problem in general relativity rather than as a claim that faster-than-light travel is presently achievable. Alcubierre-type geometries describe a nearly flat central region surrounded by a moving distortion of spacetime, but Einstein's field equations connect that geometry to stress-energy requirements that commonly include negative energy density, steep curvature, and severe tidal gradients. This project asks whether changing the mathematical profile of the bubble wall can reduce the most extreme local demands without merely shifting the difficulty into a larger total energy requirement or an unresolved numerical feature.

I will reproduce a baseline warp-bubble metric and compare four shaping-function families: a standard hyperbolic-tangent wall, a compact-support polynomial, an error-function transition, and a smooth higher-order bump profile. The comparison will vary bubble radius, wall thickness, transition smoothness, and nominal coordinate velocity within a deliberately bounded spring-only parameter grid. For each converged case, I will calculate selected 3+1 quantities, observer-dependent energy density, integrated negative energy, representative curvature invariants, and tidal accelerations across the wall.

My work will include translating the metric definitions into Python, checking analytic limits, writing unit tests, documenting all parameter choices, running the sweep, preserving failed cases, and preparing comparative figures. Results will be accepted only when they pass flat-space and zero-velocity checks, symmetry and dimensional tests, and grid-refinement analysis. My mentor will review the physical assumptions and interpretation, but I will be responsible for the computational workflow, data analysis, and written presentation of the findings.

The expected outcome is a defensible map of tradeoffs rather than a claim that a practical warp engine has been designed. A useful result may show that one profile lowers peak negative energy while increasing the integrated requirement, or that an apparent improvement disappears when the grid is refined. During January through April, I will complete the baseline model, implement and verify the alternate profiles, analyze the supported cases, and prepare a poster, manuscript-style report, and reproducible code archive for dissemination at the University of Arkansas Undergraduate Research Symposium.

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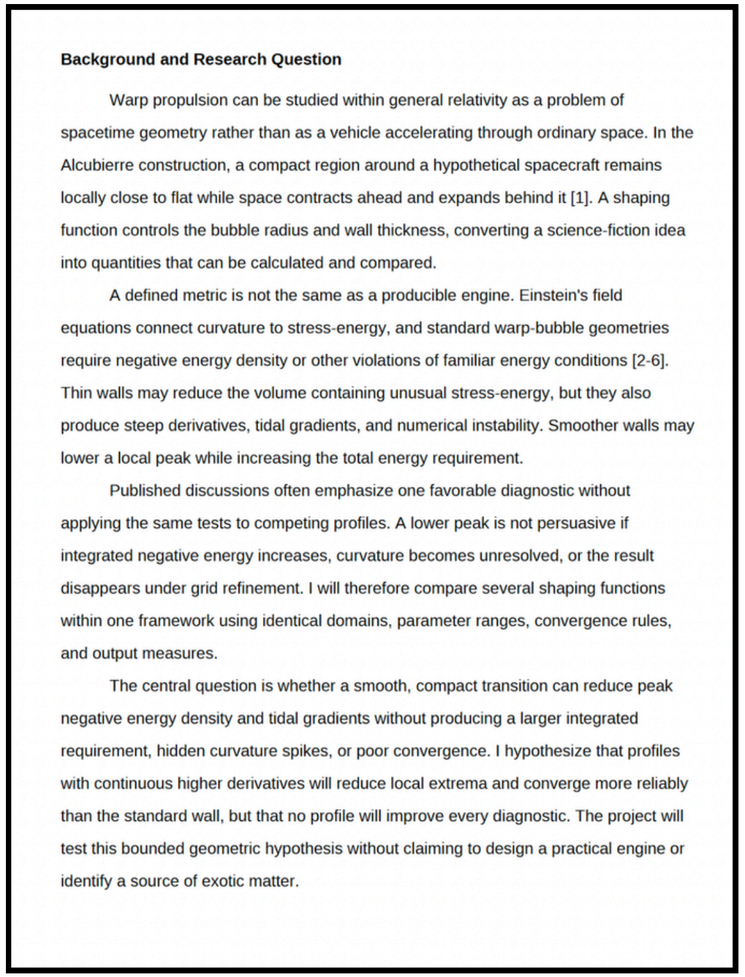
Research Proposal

- **Five pages**
- What is one thing successful proposals have in common?
  - Five peer-reviewed, outside sources in their research proposals

Timeline



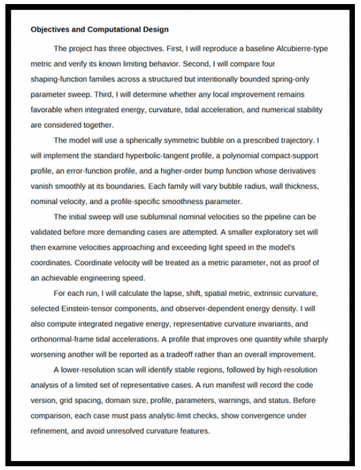
Background and Research Question

Warp propulsion can be studied within general relativity as a problem of spacetime geometry rather than as a vehicle accelerating through ordinary space. In the Alcubierre construction, a compact region around a hypothetical spacecraft remains locally close to flat while space contracts ahead and expands behind it [1]. A shaping function controls the bubble radius and wall thickness, converting a science-fiction idea into quantities that can be calculated and compared.

A defined metric is not the same as a producible engine. Einstein's field equations connect curvature to stress-energy, and standard warp-bubble geometries require negative energy density or other violations of familiar energy conditions [2-6]. Thin walls may reduce the volume containing unusual stress-energy, but they also produce steep derivatives, tidal gradients, and numerical instability. Smoother walls may lower a local peak while increasing the total energy requirement.

Published discussions often emphasize one favorable diagnostic without applying the same tests to competing profiles. A lower peak is not persuasive if integrated negative energy increases, curvature becomes unresolved, or the result disappears under grid refinement. I will therefore compare several shaping functions within one framework using identical domains, parameter ranges, convergence rules, and output measures.

The central question is whether a smooth, compact transition can reduce peak negative energy density and tidal gradients without producing a larger integrated requirement, hidden curvature spikes, or poor convergence. I hypothesize that profiles with continuous higher derivatives will reduce local extrema and converge more reliably than the standard wall, but that no profile will improve every diagnostic. The project will test this bounded geometric hypothesis without claiming to design a practical engine or identify a source of exotic matter.



Objectives and Computational Design

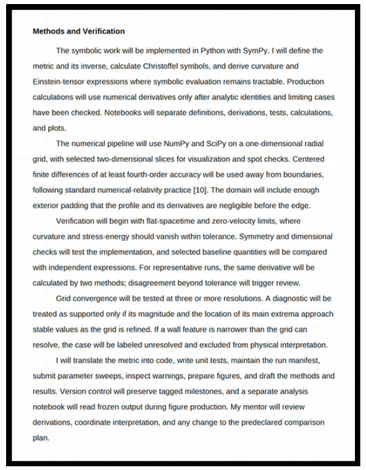
The project has three objectives. First, I will reproduce a baseline Alcubierre-type metric and verify its known limiting behavior. Second, I will compare four shaping-function families across a structured but intentionally bounded spring-only parameter sweep. Third, I will determine whether any local improvement remains favorable when integrated energy, curvature, tidal acceleration, and numerical stability are considered together.

The model will use a spherically symmetric bubble on a prescribed trajectory. I will implement the standard hyperbolic-tangent profile, a polynomial compact-support profile, an error-function profile, and a higher-order bump function whose derivatives vanish smoothly at its boundaries. Each family will vary bubble radius, wall thickness, nominal velocity, and a profile-specific smoothness parameter.

The initial sweep will use subluminal nominal velocities so the pipeline can be validated before more demanding cases are attempted. A smaller exploratory set will then examine velocities approaching and exceeding light speed in the model's coordinates. Coordinate velocity will be treated as a metric parameter, not as proof of an achievable engineering speed.

For each run, I will calculate the lapse, shift, spatial metric, extrinsic curvature, selected Einstein-tensor components, and observer-dependent energy density. I will also compute integrated negative energy, representative curvature invariants, and orthonormal-frame tidal accelerations. A profile that improves one quantity while sharply worsening another will be reported as a tradeoff rather than an overall improvement.

A lower-resolution scan will identify stable regions, followed by high-resolution analysis of a limited set of representative cases. A run manifest will record the code version, grid spacing, domain size, profile, parameters, warnings, and status. Before comparison, each case must pass analytic-limit checks, show convergence under refinement, and avoid unresolved curvature features.



Methods and Verification

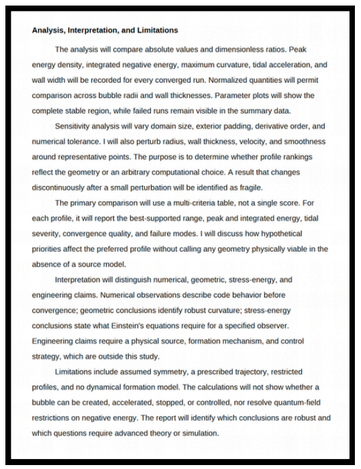
The symbolic work will be implemented in Python with SymPy. I will define the metric and its inverse, calculate Christoffel symbols, and derive curvature and Einstein-tensor expressions where symbolic evaluation remains tractable. Production calculations will use numerical derivatives only after analytic identities and limiting cases have been checked. Notebooks will separate definitions, derivations, tests, calculations, and plots.

The numerical pipeline will use NumPy and SciPy on a one-dimensional radial grid, with selected two-dimensional slices for visualization and spot checks. Centered finite differences of at least fourth-order accuracy will be used away from boundaries, following standard numerical-relativity practice [10]. The domain will include enough exterior padding that the profile and its derivatives are negligible before the edge.

Verification will begin with flat-spacetime and zero-velocity limits, where curvature and stress-energy should vanish within tolerance. Symmetry and dimensional checks will test the implementation, and selected baseline quantities will be compared with independent expressions. For representative runs, the same derivative will be calculated by two methods; disagreement beyond tolerance will trigger review.

Grid convergence will be tested at three or more resolutions. A diagnostic will be treated as supported only if its magnitude and the location of its main extrema approach stable values as the grid is refined. If a wall feature is narrower than the grid can resolve, the case will be labeled unresolved and excluded from physical interpretation.

I will translate the metric into code, write unit tests, maintain the run manifest, submit parameter sweeps, inspect warnings, prepare figures, and draft the methods and results. Version control will preserve tagged milestones, and a separate analysis notebook will read frozen output during figure production. My mentor will review derivations, coordinate interpretation, and any change to the predeclared comparison plan.



Analysis, Interpretation, and Limitations

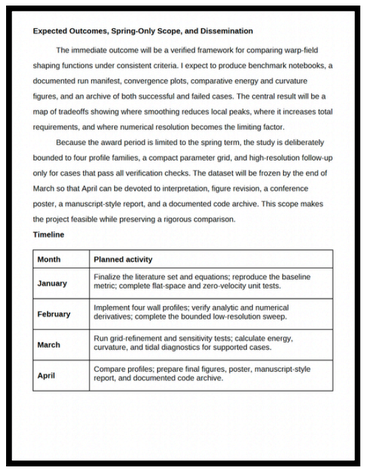
The analysis will compare absolute values and dimensionless ratios. Peak energy density, integrated negative energy, maximum curvature, tidal acceleration, and wall width will be recorded for every converged run. Normalized quantities will permit comparison across bubble radii and wall thicknesses. Parameter plots will show the complete stable region, while failed runs remain visible in the summary data.

Sensitivity analysis will vary domain size, exterior padding, derivative order, and numerical tolerance. I will also perturb radius, wall thickness, velocity, and smoothness around representative points. The purpose is to determine whether profile rankings reflect the geometry or an arbitrary computational choice. A result that changes discontinuously after a small perturbation will be identified as fragile.

The primary comparison will use a multi-criteria table, not a single score. For each profile, it will report the best-supported range, peak and integrated energy, tidal severity, convergence quality, and failure modes. I will discuss how hypothetical priorities affect the preferred profile without calling any geometry physically viable in the absence of a source model.

Interpretation will distinguish numerical, geometric, stress-energy, and engineering claims. Numerical observations describe code behavior before convergence; geometric conclusions identify robust curvature; stress-energy conclusions state what Einstein's equations require for a specified observer. Engineering claims require a physical source, formation mechanism, and control strategy, which are outside this study.

Limitations include assumed symmetry, a prescribed trajectory, restricted profiles, and no dynamical formation model. The calculations will not show whether a bubble can be created, accelerated, stopped, or controlled, nor resolve quantum-field restrictions on negative energy. The report will identify which conclusions are robust and which questions require advanced theory or simulation.



Expected Outcomes, Spring-Only Scope, and Dissemination

The immediate outcome will be a verified framework for comparing warp-field shaping functions under consistent criteria. I expect to produce benchmark notebooks, a documented run manifest, convergence plots, comparative energy and curvature figures, and an archive of both successful and failed cases. The central result will be a map of tradeoffs showing where smoothing reduces local peaks, where it increases total requirements, and where numerical resolution becomes the limiting factor.

Because the award period is limited to the spring term, the study is deliberately bounded to four profile families, a compact parameter grid, and high-resolution follow-up only for cases that pass all verification checks. The dataset will be frozen by the end of March so that April can be devoted to interpretation, figure revision, a conference poster, a manuscript-style report, and a documented code archive. This scope makes the project feasible while preserving a rigorous comparison.

Timeline

Month	Planned activity
January	Finalize the literature set and equations; reproduce the baseline metric; complete flat-space and zero-velocity unit tests.
February	Implement four wall profiles; verify analytic and numerical derivatives; complete the bounded low-resolution sweep.
March	Run grid-refinement and sensitivity tests; calculate energy, curvature, and tidal diagnostics for supported cases.
April	Compare profiles; prepare final figures, poster, manuscript-style report, and documented code archive.

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SURF Research Proposal - Content

- Address the feasibility of the project (i.e., is the project reasonable for you to pursue with the available facilities?)
- Answer the question: Is the project of sufficient difficulty to challenge you?
- Answer the question: Will the project teach you skills that are transferable to other research endeavors/scholarly activities?
- When introducing your topic, assume you are writing to a generalist in your field
- Answer the question: Is the proposed research/scholarly activity of value to your field of study? How? and Why?
- Address other criteria you deem appropriate
- Do your homework. It is important to show you know something about your field & project. (Don't forget to cite that homework.)

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SURF Research Proposal - Format

- Write in the first person (ex: “I will perform” instead of “The student researcher will perform”)
- Your works cited section does not count against the five page limit for the research proposal
- Discussion of background should account for no more than 25% of the project description
- The timeline should be indicated with a bolded header, and should outline clear and incremental goals for the project’s funding period
- The proposal should be five pages double-spaced

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Timeline

- Clear incremental goals
- Monthly or bi-weekly
- Refer to your mentor when setting these goals
- This is a Spring-Fall example

Plan and Project Timeline

Month	Goal(s)
January	• Modify 3 channel imaging box for super resolution imaging.
February	• Modify microscope with imaging box – test.
March	• Fluorophore testing to find best dyes for our case.
April	• Single color fixed super resolution imaging (validation).
August	• Multi-color fixed super resolution imaging – testing conditions for cells, media, and tagging.
September	• Experimental multi-color SMLM imaging of fixed A549 cells with selected fluorescent dyes.
October	• Continue experiments, write codes for data analysis, and analyze data.
November	• Finish data analysis, begin writing manuscript and submitting abstracts for conference talks.

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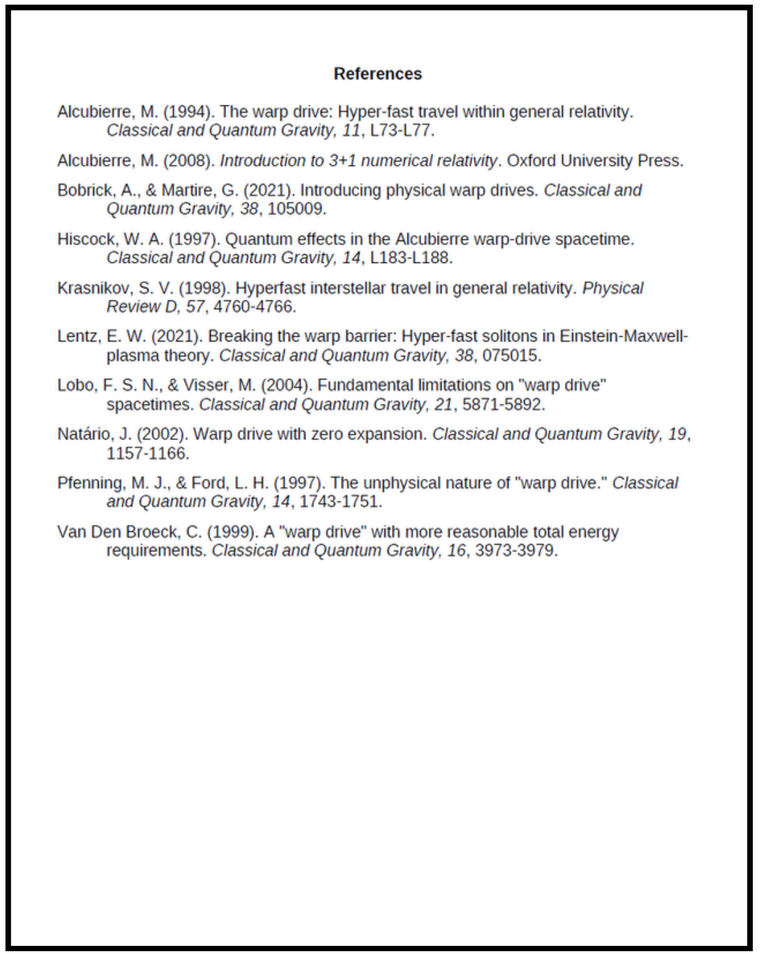
References

- At least <u>five</u> peer-reviewed sources
- Refer to your mentor for quality sources
- Use the library's resources
- Use your discipline's preferred citation style



References

Alcubierre, M. (1994). The warp drive: Hyper-fast travel within general relativity. *Classical and Quantum Gravity, 11*, L73-L77.

Alcubierre, M. (2008). *Introduction to 3+1 numerical relativity*. Oxford University Press.

Bobrick, A., & Martire, G. (2021). Introducing physical warp drives. *Classical and Quantum Gravity, 38*, 105009.

Hiscock, W. A. (1997). Quantum effects in the Alcubierre warp-drive spacetime. *Classical and Quantum Gravity, 14*, L183-L188.

Krasnikov, S. V. (1998). Hyperfast interstellar travel in general relativity. *Physical Review D, 57*, 4760-4766.

Lentz, E. W. (2021). Breaking the warp barrier: Hyper-fast solitons in Einstein-Maxwell-plasma theory. *Classical and Quantum Gravity, 38*, 075015.

Lobo, F. S. N., & Visser, M. (2004). Fundamental limitations on "warp drive" spacetimes. *Classical and Quantum Gravity, 21*, 5871-5892.

Natário, J. (2002). Warp drive with zero expansion. *Classical and Quantum Gravity, 19*, 1157-1166.

Pfenning, M. J., & Ford, L. H. (1997). The unphysical nature of "warp drive." *Classical and Quantum Gravity, 14*, 1743-1751.

Van Den Broeck, C. (1999). A "warp drive" with more reasonable total energy requirements. *Classical and Quantum Gravity, 16*, 3973-3979.

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Jay McAllister

Engineering and Honors College

Librarian

jtmcalli@uark.edu

479-575-2480

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SURF Evaluation

- Your SURF application will be evaluated by a state-appointed faculty committee.
- Your part of the application constitutes the bulk of the review

--Scores for each criteria are on a 1-9 scale, 1 being the best score and 9 being the worst score--

Definitely Fund ← *Possibly Fund* → *Do Not Fund*

1	2	3	4	5	6	7	8	9
Superior	Excellent	Above Average	Good	Average	Fair	Below Average	Minimal	Poor

Scoring Criteria	Points
Student's Academic Success: GPA, Extracurricular Activities, Leadership, etc.	9 - Poor
Qualifications of the Mentor and Research Team (if applicable): Clear plan for support, research history, experience in the field of proposal, contributions to undergraduate research.	9 - Poor
Innovation/Originality: Generates new ideas and/or applies existing ideas in a new context.	9 - Poor
Significance of the Study: Outcomes are clearly proposed and Impact is anticipated. **STEM** – Addresses an area of importance to the discipline and shows potential to advance the science. **Non-STEM** - Expands knowledge of best/creative practices in the field, increases creative output.	9 - Poor
Appropriateness of the methodology: **STEM** - Research design, Sampling approach, Data collection protocol/plan, Data analysis procedure/plan, Protection of human subjects and/or plan for seeking IRB approval. **Non-STEM** – Preliminary Research showing selection and citation of primary and secondary sources, Hermeneutic framework, analytical approach is well defined or creative process and products are well planned/described.	9 - Poor
Merit: **STEM** - Utilizes established scientific principles, Demonstrates how scientific knowledge will be gained, Problem/topic being investigated is of value to the larger scientific community. **Non-STEM** – Uses best practices and innovative approaches in the field, betters the understanding of the human experience, benefits and engages the fields community.	9 - Poor
Other Criteria: Reference Letters, plan for dissemination, appropriate budget, feasibility of completing the project in projected timeframe, cohesiveness and coherency, clarity of writing	9 - Poor
(Add all points together) **Total Points**	

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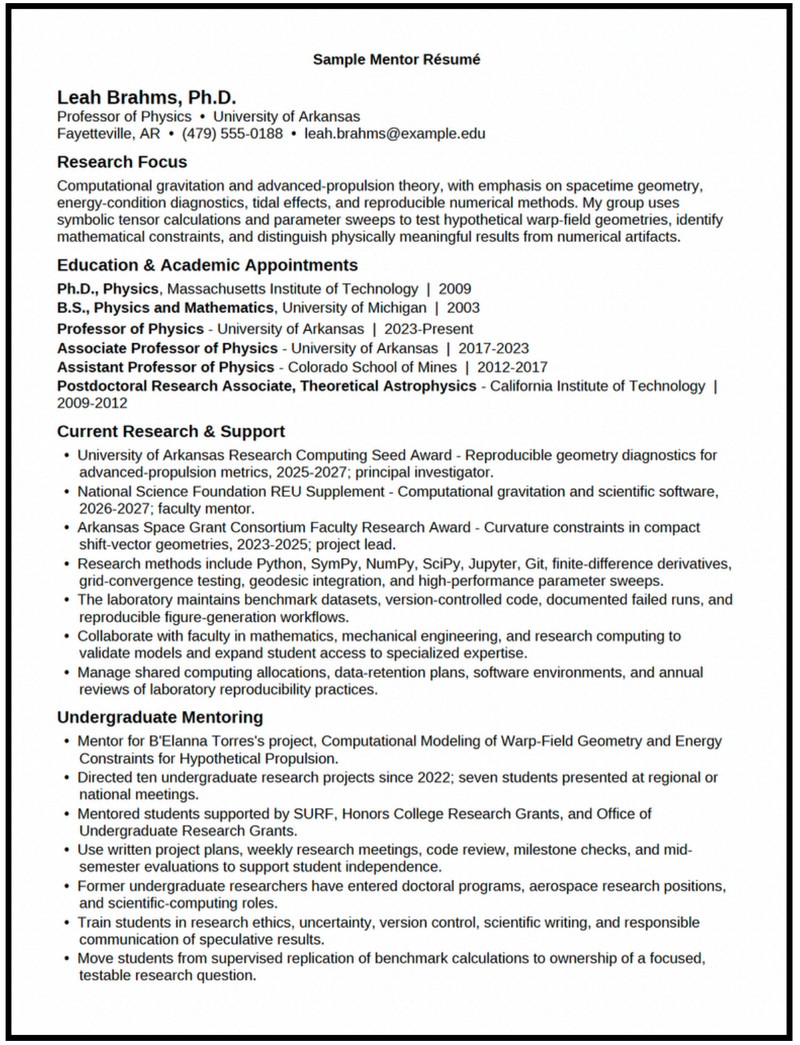
Mentor CV

- **Two-page maximum**
- The sections in this example only are a suggestion



Sample Mentor Résumé

Leah Brahms, Ph.D.
Professor of Physics • University of Arkansas
Fayetteville, AR • (479) 555-0188 • leah.brahms@example.edu

Research Focus

Computational gravitation and advanced-propulsion theory, with emphasis on spacetime geometry, energy-condition diagnostics, tidal effects, and reproducible numerical methods. My group uses symbolic tensor calculations and parameter sweeps to test hypothetical warp-field geometries, identify mathematical constraints, and distinguish physically meaningful results from numerical artifacts.

Education & Academic Appointments

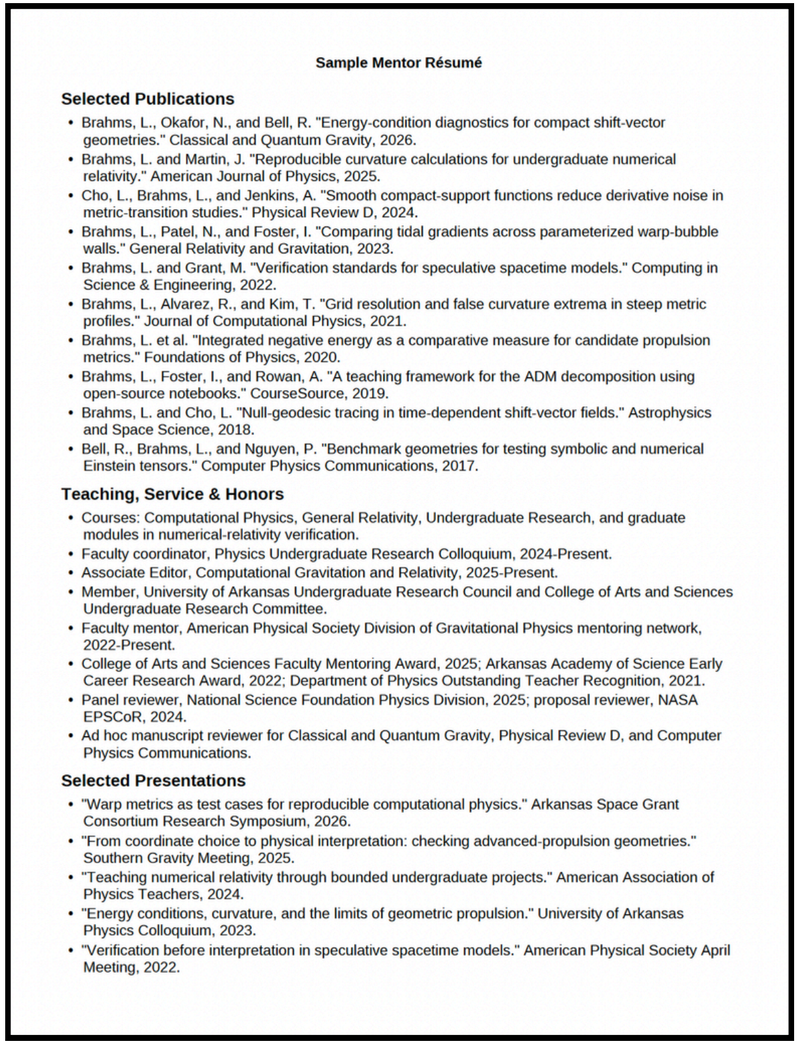
Ph.D., Physics, Massachusetts Institute of Technology | 2009
B.S., Physics and Mathematics, University of Michigan | 2003
Professor of Physics - University of Arkansas | 2023-Present
Associate Professor of Physics - University of Arkansas | 2017-2023
Assistant Professor of Physics - Colorado School of Mines | 2012-2017
Postdoctoral Research Associate, Theoretical Astrophysics - California Institute of Technology | 2009-2012

Current Research & Support

- University of Arkansas Research Computing Seed Award - Reproducible geometry diagnostics for advanced-propulsion metrics, 2025-2027; principal investigator.
- National Science Foundation REU Supplement - Computational gravitation and scientific software, 2026-2027; faculty mentor.
- Arkansas Space Grant Consortium Faculty Research Award - Curvature constraints in compact shift-vector geometries, 2023-2025; project lead.
- Research methods include Python, SymPy, NumPy, SciPy, Jupyter, Git, finite-difference derivatives, grid-convergence testing, geodesic integration, and high-performance parameter sweeps.
- The laboratory maintains benchmark datasets, version-controlled code, documented failed runs, and reproducible figure-generation workflows.
- Collaborate with faculty in mathematics, mechanical engineering, and research computing to validate models and expand student access to specialized expertise.
- Manage shared computing allocations, data-retention plans, software environments, and annual reviews of laboratory reproducibility practices.

Undergraduate Mentoring

- Mentor for B'Elanna Torres's project, Computational Modeling of Warp-Field Geometry and Energy Constraints for Hypothetical Propulsion.
- Directed ten undergraduate research projects since 2022; seven students presented at regional or national meetings.
- Mentored students supported by SURF, Honors College Research Grants, and Office of Undergraduate Research Grants.
- Use written project plans, weekly research meetings, code review, milestone checks, and mid-semester evaluations to support student independence.
- Former undergraduate researchers have entered doctoral programs, aerospace research positions, and scientific-computing roles.
- Train students in research ethics, uncertainty, version control, scientific writing, and responsible communication of speculative results.
- Move students from supervised replication of benchmark calculations to ownership of a focused, testable research question.



Sample Mentor Résumé

Selected Publications

- Brahms, L., Okafor, N., and Bell, R. "Energy-condition diagnostics for compact shift-vector geometries." Classical and Quantum Gravity, 2026.
- Brahms, L. and Martin, J. "Reproducible curvature calculations for undergraduate numerical relativity." American Journal of Physics, 2025.
- Cho, L., Brahms, L., and Jenkins, A. "Smooth compact-support functions reduce derivative noise in metric-transition studies." Physical Review D, 2024.
- Brahms, L., Patel, N., and Foster, I. "Comparing tidal gradients across parameterized warp-bubble walls." General Relativity and Gravitation, 2023.
- Brahms, L. and Grant, M. "Verification standards for speculative spacetime models." Computing in Science & Engineering, 2022.
- Brahms, L., Alvarez, R., and Kim, T. "Grid resolution and false curvature extrema in steep metric profiles." Journal of Computational Physics, 2021.
- Brahms, L. et al. "Integrated negative energy as a comparative measure for candidate propulsion metrics." Foundations of Physics, 2020.
- Brahms, L., Foster, I., and Rowan, A. "A teaching framework for the ADM decomposition using open-source notebooks." CourseSource, 2019.
- Brahms, L. and Cho, L. "Null-geodesic tracing in time-dependent shift-vector fields." Astrophysics and Space Science, 2018.
- Bell, R., Brahms, L., and Nguyen, P. "Benchmark geometries for testing symbolic and numerical Einstein tensors." Computer Physics Communications, 2017.

Teaching, Service & Honors

- Courses: Computational Physics, General Relativity, Undergraduate Research, and graduate modules in numerical-relativity verification.
- Faculty coordinator, Physics Undergraduate Research Colloquium, 2024-Present.
- Associate Editor, Computational Gravitation and Relativity, 2025-Present.
- Member, University of Arkansas Undergraduate Research Council and College of Arts and Sciences Undergraduate Research Committee.
- Faculty mentor, American Physical Society Division of Gravitational Physics mentoring network, 2022-Present.
- College of Arts and Sciences Faculty Mentoring Award, 2025; Arkansas Academy of Science Early Career Research Award, 2022; Department of Physics Outstanding Teacher Recognition, 2021.
- Panel reviewer, National Science Foundation Physics Division, 2025; proposal reviewer, NASA EPSCoR, 2024.
- Ad hoc manuscript reviewer for Classical and Quantum Gravity, Physical Review D, and Computer Physics Communications.

Selected Presentations

- "Warp metrics as test cases for reproducible computational physics." Arkansas Space Grant Consortium Research Symposium, 2026.
- "From coordinate choice to physical interpretation: checking advanced-propulsion geometries." Southern Gravity Meeting, 2025.
- "Teaching numerical relativity through bounded undergraduate projects." American Association of Physics Teachers, 2024.
- "Energy conditions, curvature, and the limits of geometric propulsion." University of Arkansas Physics Colloquium, 2023.
- "Verification before interpretation in speculative spacetime models." American Physical Society April Meeting, 2022.

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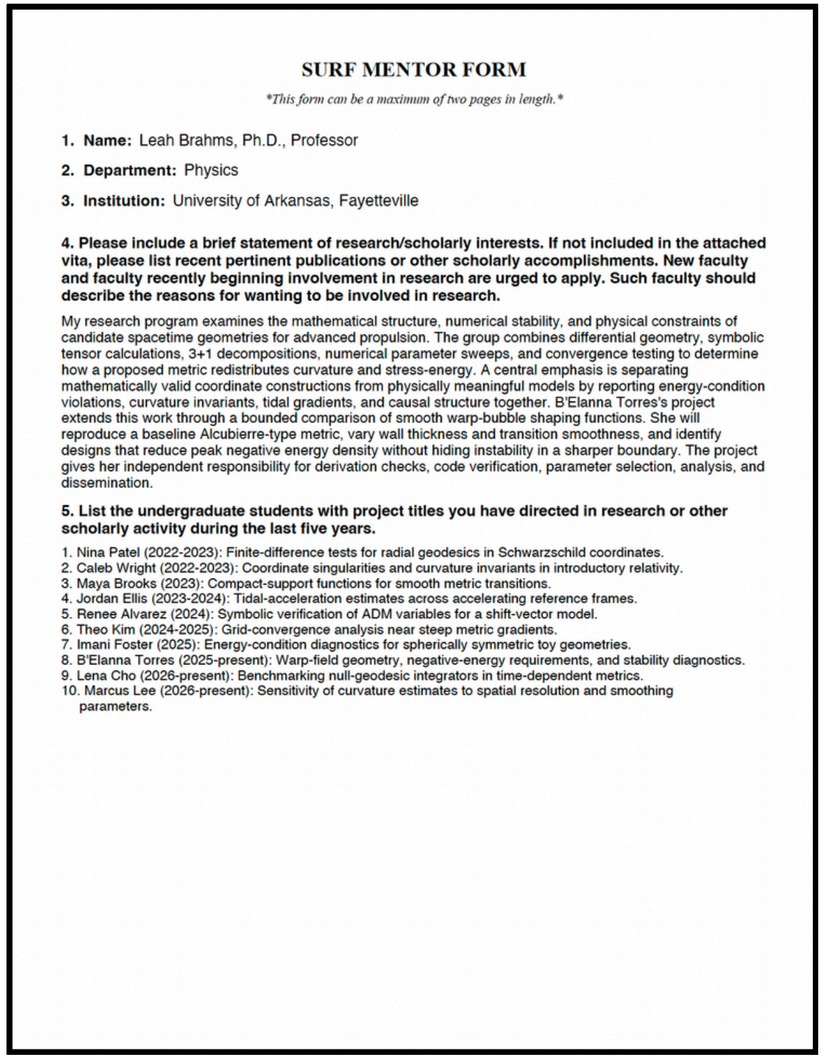
SURF Mentor Form

(This form is in addition to the two page Mentor CV)

- **Two-page maximum**
- A brief statement of research/scholarly interests
- If not included on mentor CV:
  - A list of undergraduate students whom the mentor has supervised
  - Project titles the mentor has directed in scholarly research
  - Representative publications



SURF MENTOR FORM

This form can be a maximum of two pages in length.

1. **Name:** Leah Brahms, Ph.D., Professor
2. **Department:** Physics
3. **Institution:** University of Arkansas, Fayetteville

4. Please include a brief statement of research/scholarly interests. If not included in the attached vita, please list recent pertinent publications or other scholarly accomplishments. New faculty and faculty recently beginning involvement in research are urged to apply. Such faculty should describe the reasons for wanting to be involved in research.

My research program examines the mathematical structure, numerical stability, and physical constraints of candidate spacetime geometries for advanced propulsion. The group combines differential geometry, symbolic tensor calculations, 3+1 decompositions, numerical parameter sweeps, and convergence testing to determine how a proposed metric redistributes curvature and stress-energy. A central emphasis is separating mathematically valid coordinate constructions from physically meaningful models by reporting energy-condition violations, curvature invariants, tidal gradients, and causal structure together. B'Elanna Torres's project extends this work through a bounded comparison of smooth warp-bubble shaping functions. She will reproduce a baseline Alcubierre-type metric, vary wall thickness and transition smoothness, and identify designs that reduce peak negative energy density without hiding instability in a sharper boundary. The project gives her independent responsibility for derivation checks, code verification, parameter selection, analysis, and dissemination.

5. List the undergraduate students with project titles you have directed in research or other scholarly activity during the last five years.

1. Nina Patel (2022-2023): Finite-difference tests for radial geodesics in Schwarzschild coordinates.
2. Caleb Wright (2022-2023): Coordinate singularities and curvature invariants in introductory relativity.
3. Maya Brooks (2023): Compact-support functions for smooth metric transitions.
4. Jordan Ellis (2023-2024): Tidal-acceleration estimates across accelerating reference frames.
5. Renee Alvarez (2024): Symbolic verification of ADM variables for a shift-vector model.
6. Theo Kim (2024-2025): Grid-convergence analysis near steep metric gradients.
7. Imani Foster (2025): Energy-condition diagnostics for spherically symmetric toy geometries.
8. B'Elanna Torres (2025-present): Warp-field geometry, negative-energy requirements, and stability diagnostics.
9. Lena Cho (2026-present): Benchmarking null-geodesic integrators in time-dependent metrics.
10. Marcus Lee (2026-present): Sensitivity of curvature estimates to spatial resolution and smoothing parameters.

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Mentor Letter of Support

- Address all letters to the SURF Selection Committee
- Address student's academic (especially research) abilities and performances
- Outline significance of the student's project
- Indicate student's ability to complete the project
- Comment on student's ability to meet the schedule and to live up to commitments
- Outline the mentor's advisory role, explaining what the mentor has to bring to the project
- Must be on **official letterhead and signed**
- Letters will be submitted through InfoReady

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Additional Reference Letters

- The additional letters of support should come from academic faculty who have taught you or supervised your research. Professional letters or letters of character are not helpful to the SURF application. Letters should not be written by graduate assistants.
- Address all letters to the SURF Selection Committee
- Address student's academic (especially research) abilities and performances
- Relay, whenever possible, specific examples of the student's merit and potential
- Must be on **official letterhead and signed**
- Letters will be submitted through InfoReady

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Four Applicants Per Mentor

- Mentors are allowed a maximum of four SURF applicants
- If you have more than four, then they may apply through SURF for an HCRG or OURG
- If you have more than four student researchers applying for funding, please let us know (awards@uark.edu) which ones should be considered for SURF

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Transcript Request

registrar.uark.edu

Transcript Request

- The University of Arkansas transcript is a **complete** record of the student's enrollment and academic history at the University of Arkansas, including **all** undergraduate, graduate, and law courses. Partial transcripts based on a student's career (undergraduate, graduate, or law), or transcripts that include only selected coursework, are not available. Click here to view our transcript guide. For current grades and marks, click here.
- All financial obligations to the University of Arkansas must be met before an official transcript can be released.
- Transcripts may not be picked up by a third party unless the student has given written authorization with the request.
- A photo ID is required for transcript pickup.
- There is a cost of $10.00 per official transcript.

Request Methods

Transcripts can be requested by the following methods:

Online

The University of Arkansas has authorized Parchment to provide our online transcript ordering system. You can order transcripts using a Visa or MasterCard at any time of the day or week. Parchment will process transcript orders from 8:00 AM to 5:00 PM Monday through Friday. Your credit card will be charged when your order is complete.

- Click here to order an official transcript(s) through the Parchment site.
- Click "Ordering your own credentials or academic records" or "Ordering on behalf of someone else" and the Parchment site will provide instructions for placing your order, including delivery options and fees. You can order as many transcripts as you like in a single session at $10.00 per transcript. Parchment charges a $2.75 processing fee for each recipient (transcript addressee).
- Order updates will be emailed to you. You can also check order status and history online here.
- If you need assistance or have questions about Parchment transcript ordering service, please go here.

In-Person

Bring a photo ID to the Office of the Registrar at 146 Silas H. Hunt Hall or at 1083 East Sain Ave. in Fayetteville. Transcripts can only be released with the written authorization of the student. Identification will be required for transcripts to be picked up in person. Payment must be made by cash or check only.

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Screenshot of Current Courses from Workday

- Make sure it shows your credit load
- This is to verify that you are enrolled full time this (fall) semester

My Enrolled Courses 10 items

	Course Listing	Actions	Units	Grading Basis	Section	Registration Status	Instructional Format	Delivery Mode	Meeti
	[redacted]	Actions	1	Graded	[redacted]	Registered	Laboratory	In-Person	[redacted]
	[redacted]	Actions	3	Graded	[redacted]	Registered	Lecture	In-Person	[redacted]
	[redacted]				[redacted]	Registered	Discussion	In-Person	[redacted]
	[redacted]	Actions	1	Graded	[redacted]	Registered	Experiential	In-Person	[redacted]
	[redacted]	Actions	2	Graded	[redacted]	Registered	Lecture	In-Person	[redacted]
	[redacted]	Actions	3	Graded	[redacted]	Registered	Lecture	In-Person	[redacted]
	[redacted]	Actions	3	Graded	[redacted]	Registered	Seminar	In-Person	[redacted]
	[redacted]	Actions	3	Graded	[redacted]	Registered	Lecture	In-Person	[redacted]
	[redacted]	Actions	1	Graded	[redacted]	Registered	Seminar	In-Person	[redacted]
	[redacted]		0	Graded	[redacted]	Registered	Discussion	In-Person	[redacted]

My Dropped/Withdrawn Courses

Enrolled Units [redacted]

Load Status [redacted]

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Stipend Funding Periods

Spring	→	$1,250 One-Semester	(common)
Spring-Summer	→	$2,500 Two-Semester	(rare)
Spring-Fall	→	$2,500 Two-Semester	(common)
Spring-Summer-Fall	→	$2,500 Two-Semester	(rare)

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Honors College Research Grant (HCRG) and Office of Undergraduate Research Grant (OURG)

Dr. Chelsea Hodge

Dr. Jennie Popp

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SURF Spring-Fall Example

	SURF	UA Match	Sub-total		Total	HCRG*	OURG*
Student Stipend							
Spring	625	625	1250		1250	1250	1250
Fall	625	625	1250		1250		
Mentor Funds	750		750	(+250)	1000	1000	1000
Student Travel	750		750		750	(HCCTG)	
TOTAL:			4000		4250	2250	2250

*Can only receive one semester of funding each academic year.

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SURF Reporting Requirements

- SURF awardees follow the same internal reporting guidelines that HCRG and OURG awardees follow
- Honors College deliverables
    - Blog and photo (at the end of each semester funded) – be featured on the HNRC blog site honorsstories.uark.edu
    - Final report (can submit same report as required by SURF)
- Instructions will be provided by the Honors College at time of the award

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Final One-Page Abstract

At the completion of your funding period, you are required to submit a one-page abstract to ADHE.

- May 1 Spring term project completion
- August 1 Summer term project completion
- December 1 Fall term project completion

Present Your Research

"Fellowship recipients are required to present the findings of his/her research at a state or national conference in his/her discipline or attend a meeting of experts in his/her discipline as directed by his/her mentor."

- ADHE

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SURF Collection - October 14th-16th

SURF Early Review

- Students are encouraged to participate in an early review. Please schedule an appointment with Matthew Halbert if you would like your application reviewed prior to Collection.

SURF Collection

- At SURF Collection, any registrants who have not participated in an early review will have their application reviewed by a University of Arkansas faculty or staff member during a Microsoft Teams appointment.
- **These appointments will be available to choose on October 1st**.

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It's ok, and required, to click submit

before your SURF Collection

Submit

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After Your SURF Submission

- Next Steps
  - December-January: SURF Contract via email from ADHE
  - January-February: Terms and Conditions via email from Matthew Halbert.
  - March-April: Worktags via email from Matthew Halbert/OSP.
- For use of the Travel Stipend (student or mentor), contact your departmental representative **prior** to your travel.

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$7,500

Campus deadline: December 1

Goldwater Scholarship

Applications judged on the basis of outstanding academic performance, as well as a demonstrated potential for and commitment to a career in mathematics, the sciences, and engineering (except applied) career. The University of Arkansas can nominate four current sophomores or juniors. Five if one is a transfer student.

Eligibility:

- Be a U.S. citizen, resident alien, or U.S. national
- Currently enrolled as a sophomore or junior
- Pursue a Bachelor's degree full time in mathematics, science, or engineering (not applied engineering)

Award:

- Sophomores may qualify for two years of support; juniors for one year.

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$7,000

Campus deadline: February 15

Udall Scholarship

The Udall Scholarship seeks outstanding, full-time sophomores and juniors from all ethnic backgrounds who intend to pursue environmental or public policy careers. The Udall Scholarship also seeks Native American and Alaska Native sophomores and juniors who intend to pursue health care or tribal public policy careers. Typical areas of study include (but are not limited to): environmental engineering, natural sciences, resource management, social sciences, and Native American public policy.

Eligibility:

- Be a U.S. citizen, permanent resident, or national
- Be a sophomore or junior with a minimum 3.0 GPA
- Currently pursue a Bachelor's degree that leads to an environmental public policy career, or, in the case of Native American or Alaska Native Students, plan a career in health care and tribal public policy
- Demonstrate the commitment and potential to make a significant contribution to their field of study

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Office of Nationally Competitive Awards

Suzanne McCray

Vice Provost of Enrollment Dean of Admissions and Nationally Competitive Awards

Emily Voight

Senior Associate Director of Nationally Competitive Awards

Fulbright Program Advisor

Matthew Halbert

Associate Director of Nationally Competitive Awards

SURF Coordinator

Robert Ellis

Assistant Director of Nationally Competitive Awards

Managing Editor, Inquiry

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SURF Registration

Celebrating Discovery

ONCA Instagram