

Sylvia Mesicek

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EDUCATION

University of Utah

Honors Bachelors of Science in Physics

Cumulative GPA: 4.00 / 4.00 (Summa Cum Laude)

Salt Lake City, Utah

Aug. 2022 - May 2026

University of Utah

Honors Bachelors of Science in Mathematics

Minor: Astronomy

Cumulative GPA: 4.00 / 4.00 (Summa Cum Laude)

Salt Lake City, Utah

Aug. 2022 - May 2026

Salt Lake Center for Science Education

High School Diploma

Cumulative GPA: 4.00 / 4.00

Salt Lake City, Utah

Aug. 2019 - June 2022

RESEARCH

Critical Collapse of Black Holes with Finite Difference Methods

Sep. 2022 - Present

- Developed advanced codebase (20,000 lines of code) from scratch for numerically solving PDEs.
- Derived a novel hyperbolic formulation of the Z_4 extended Einstein Field Equations in axisymmetry.
- Designed and implemented innovative methods for adaptively refining domains using interpolating wavelets.

Advisor: **Dr. John Belz**

X-ray Spectral Analysis of AGN in the NEP field

May. 2025 - Present

- Performed x-ray spectroscopic analysis on XMM-Newton observations of 62 selected AGN in the JWST-North Ecliptic Pole field.
- Used Bayesian analysis and frequentist best-fit models to measure and constrain N_H values of these AGN.
- Supplemented prior work studying obscured AGN in the NEP field.

Advisor: **Dr. Dan Wik**

Formal Verification of Operating Systems

Sep. 2022 - May 2024

- Verified correctness of low-level OS code by building proofs with Dafny and Verus.
- Built formally verified abstractions for memory allocators and linked lists.
- Coauthored paper on work presented at SOSP 2023, a leading conference in operating systems programming.

Advisor: **Dr. Anton Burtsev**

PUBLICATIONS

- **Discontinuous Galerkin Method Applied to Critical Phenomena in Gravitational Collapse.** S. Johnson, S. Mesicek, and J. Belz. Submitted to *Phys. Rev. D* (2025).
- **Atmosphere: Towards Practical Verified Kernels in Rust.** Xiangdong C., Zhaofeng L., Mesicek L.¹, Narayanan V., and Burtsev A. Published in *KISV '23: Proceedings of the 1st Workshop on Kernel Isolation, Safety and Verification* (2023).

PRESENTATIONS

- **Simulating Black Hole Collapse from Axisymmetric Scalar Fields using Modern Finite Difference Techniques.**
American Physical Society (4 Corners Conference) - Logan, Utah. Oct. 2023
L. Mesicek¹, Sean Johnson, John Belz.
- **Axisymmetric Critical Phenomena using High Order Finite Difference Methods.**
University of Utah Undergraduate Research Symposium - Salt Lake City, Utah. Aug. 2023
L. Mesicek¹, Sean Johnson, John Belz.

ADVANCED COURSEWORK

Graduate level: Electrodynamics & Special Relativity, General Relativity, Stars and Stellar Populations, Cosmology, Statistical Methods for Astronomers, Analysis of Numerical Methods, Differentiable Manifolds, Group Theory, Algebraic Topology

Undergraduate level: Classical Mechanics, Quantum Mechanics, Computational Physics, Thermodynamics & Statistical Mechanics, Observational Astronomy, Abstract Algebra, Topology I, Topology II

TECHNICAL SKILLS

Languages: C/C++, Python, Rust, Julia, Fortran

Libraries: NumPy, SciPy, Pandas, Matplotlib, AstroPy, SymPy

Miscellaneous: LaTeX, ParaView, Xspec

AWARDS AND RECOGNITION

- J.L. Gibson Senior Award** 2026
Awarded by the University of Utah Department of Mathematics to graduating seniors with the highest GPA.
- Barry Goldwater Scholarship** 2025
Awarded by the Barry Goldwater Scholarship and Excellence in Education Foundation for outstanding career and research potential in physics and astronomy.
- Walter W. Wada Endowed Scholarship** 2025
Awarded by the University of Utah's Department of Physics and Astronomy to an outstanding undergraduate student.
- Michael Zhao Memorial Scholarship** 2025
Awarded by the University of Utah's Department of Mathematics to an outstanding undergraduate student.
- James B. & Betty Debenham Scholarship** 2024
Awarded by the University of Utah's Honors College for outstanding student involvement and achievement on the path to an Honors Degree.
- University Opportunity Research Program** 2024
Awarded by the University of Utah's Office of Undergraduate Research to fund my work with Dr. Belz in the spring and summer of 2024.

¹Citation under previous name.

College of Science Dean's Scholarship

2023, 2024, 2025

Awarded by the University of Utah's College of Science for outstanding undergraduate academic achievement in science classes.

Summer Undergraduate Research Fellowship

2023

Awarded by the University of Utah's Department of Physics and Astronomy for academic merit and research experience to fund my work with Dr. Belz over the summer of 2023.

Sweet Candy Scholarship

2023

Awarded by the University of Utah's Honors College for outstanding student involvement and achievement on the path to an Honors Degree.

Physics and Astronomy Recognition of Excellence

2022 & 2023

Awarded by the University of Utah's Physics and Astronomy for outstanding undergraduate academic achievement in physics classes.

University of Utah Flagship Scholarship

2022 - 2026

A merit scholarship awarded by the University of Utah to incoming freshman for academic achievement in high school.