

Adam Michael Bauer

Graduate Research Assistant & Predoctoral Research Scientist

@ adammb4@illinois.edu

adam-bauer-34.github.io

adam-bauer-34

Champaign, IL, USA

RESEARCH INTERESTS

Nonlinear Dynamical Systems

Extreme Heating Events

Climate Science

Soil Moisture Dynamics

Social Cost of Carbon

Mathematical Modeling

EDUCATION

Ph. D. Physics

University of Illinois at Urbana Champaign 2020 –

- Currently enrolled in the physics doctoral program.
- Cumulative GPA: 4.000

B.S. Physics & B.S. Mathematics

University of Arizona 2016 – 2020

- Minor: Astronomy and Astrophysics
- Cumulative GPA: 3.972 (Summa Cum Laude)
- Thesis: *On the Behavior of Null Rays in Spherically Symmetric Spacetimes*

CURRENT RESEARCH PROJECTS

Building a Hasselmann-like model for soil moisture dynamics

Advisor: Prof. Cristian Proistosescu

University of Illinois at Urbana Champaign Jan 2021 – Present Urbana, IL

- Used reanalysis data to investigate the relationship between near surface temperature and soil moisture.
- Analytically derived a one-dimensional Hasselmann-like model for soil moisture dynamics.
- Built a numerical simulation that simulated near-surface climate dynamics to probe the frequency and intensity of heat waves in the future.
- *Outcome:* An in preparation publication.

Updating EZClimate using an enhanced climate emulator

Advisor: Prof. Cristian Proistosescu & Prof. Gernot Wagner

University of Illinois at Urbana Champaign & Columbia Business School May 2021 – Present Urbana, IL

- Implemented the *Transient Climate Response to Emissions* into EZClimate, an integrated assessment model used to calculate the cost of carbon.
- Implemented an upgraded model of the carbon cycle to more accurately represent climate physics within EZClimate.
- *Outcome:* An in preparation publication.

PAST RESEARCH PROJECTS

Using accretion physics to test general relativity

Advisor: Prof. Nicolás Yunes & Prof. Charles Gammie

University of Illinois at Urbana Champaign Dec 2020 – Oct 2021 Urbana, IL

- Performed analytic calculations of accretion disk flow properties in a modified theory of gravity.
- Built a ray tracing code to calculate the intensity profile of a black hole accretion disk in a modified theory of gravity.
- Investigated the feasibility of testing general relativity using the Event Horizon Telescope.
- *Outcome:* A first-author publication that's been published in *The Astrophysical Journal*.

Near-horizon null rays in stationary spherically symmetric spacetimes

Advisor: Prof. Samuel Gralla

University of Arizona Aug 2019 – Sep 2019 Tucson, AZ

- Utilized Penrose limit metrics and perturbation theory to further investigate the Aretakis instability of extremal black holes.
- *Outcome:* Senior thesis.

Transonic canards in the stellar wind problem

Advisor: Prof. Paul Carter

University of Arizona Jan 2019 – Dec 2020 Tucson, AZ

- NSF REU internship where we proved the existence of a canard-shock solution in the hydrodynamic equations governing gas surrounding a star, including the effects of heat conduction and viscosity using geometric singular perturbation theory results.
- *Outcome:* A first-author publication in *SIAM Journal on Applied Dynamical Systems*.

Data-driven investigation of massive galaxy cluster lensing properties

Advisor: Prof. Brenda Frye

 University of Arizona  Sep 2016 – May 2019  Tucson, AZ

- Developed a numerical algorithm to reduce and analyze observational data.
- Used observational data to measure the redshift of galaxy cluster members and calculated the total cluster mass.
- Fully funded by University of Arizona/NASA Space Grant from Aug 2018 – May 2019.
- *Outcomes:* Two publications in *The Astrophysical Journal* and publication of an open-source user's manual.

REFEREED PUBLICATIONS

M. Pascale, B. L. Frye, L. Dai, N. Foo, Y. Qin, R. Leimbach, **A. M. Bauer**, E. Merlin, D. Coe, J. Diego, H. Yan, A. Zitrin, S. H. Cohen, C. Conselice, H. Dole, K. Harrington, R. A. Jansen, P. Kamiński, R. A. Windhorst, M. Yun. Possible ongoing merger discovered by photometry and spectroscopy in the field of the galaxy cluster PLCK G165.7+67.0. *Submitted*, 2022.

A. M. Bauer, A. Cárdenas-Avendaño, C. F. Gammie, N. Yunes. Spherical accretion in alternative theories of gravity. *The Astrophysical Journal*, 925:2, 2022.

A. Bauer, P. Carter. Existence of transonic solutions in the stellar wind problem with viscosity and heat conduction. *SIAM Journal on Applied Dynamical Systems*, 20:1, 2021.

B. L. Frye, M. Pascale, Y. Qin, A. Zitrin, J. Diego, G. Walth, H. Yan, C. J. Conselice, M. Alpaslan, **A. Bauer**, L. Busoni, D. Coe, S. H. Cohen, M. Dole, M. Donahue, I. Georgiev, R. A. Jansen, M. Limousin, R. Livermore, D. Norman, S. Rabien, R. A. Windhorst. PLCK G165.7+67.0: Analysis of a massive lensing cluster in a Hubble Space Telescope census of sub-millimeter giant arcs selected using Planck/Herschel. *The Astrophysical Journal*, 871:51, 2019.




UNREFEREED PUBLICATIONS

A. Bauer, B. Frye. THELI Reduction Software: A write up for inexperienced data reducers. Posted to THELI forums & Cloudynights.com, 2019. (Theli Link.) (Cloudynights Link.)

PEDAGOGICAL WORK

Analytic Formal Report Development and Implementation (PI)



Collaborators: Prof. Shawn Jackson, Danielle Dickinson

 University of Arizona  Jan 2020 – May 2021  Tucson, AZ

- Led the development of the Analytic Formal Report, a new assignment for upper division physics students.
- Graded AFRs and held office hours to help students with them in the 2020 spring semester.
- Mentored Danielle Dickinson, who performed my spring 2020 duties, in the spring 2021 semester.

TALKS AND PRESENTATIONS

Characterization and Analysis of Massive Space Telescopes

Arizona Space Grant Symposium  Apr 2019  Tempe, AZ

Measuring the Dynamical Masses of Sub-millimeter Selected Gravitational Lenses

Steward Observatory Internal Symposium  Sep 2018  Tucson, AZ

Measuring Masses of Galaxy Clusters

Galileo Circle Scholarship Banquet  Apr 2018  Tucson, AZ

ACADEMIC HONORS AND ACHIEVEMENTS

NSF Graduate Research Fellowship Program

Award offered – 2022-2025

Predoctoral Research Scientist Position

Columbia School of Business – 2022

NSF Graduate Research Fellowship Program

Honorable Mention – 2020

The Excellence in Undergraduate Research Award

UArizona College of Science – 2020

The Excellence in Undergraduate Research Award

UArizona Department of Physics – 2020

University of Arizona/NASA Space Grant Intern

2018 – 2019

Phi Beta Kappa Society

Alpha of Arizona Chapter – 2018

Galileo Circle Scholar

2018 – 2019

Weaver Research Award

UArizona Department of Physics, 2017 – 2018

Highest Academic Achievement

UArizona, 2016 – 2017, 2018 – 2019, & 2019 – 2020

SCHOLARSHIPS AWARDED

Glenn C. Purviance Scholarship

UArizona Department of Physics, 2019 – 2020

Grogan Scholarship

UArizona Department of Mathematics, 2019 – 2020

Gregson Award

UArizona Department of Physics, 2019 – 2020

Douglass/Langadas Scholarship

UArizona Department of Astronomy, 2018 – 2019

TEACHING EXPERIENCE

Graduate Teaching Assistant

Course: *PHYS 102 – College Physics: E&M and Modern*

🏛️ University of Illinois Urbana Champaign 📅 Aug 2020 – Dec 2020 📍 Urbana, IL

- Made the **List of Teachers Ranked as Excellent By Their Students**.
- Led discussion sections for introductory physics course designed for non-physics majors.
- Prepared small lectures and held extra exam review sessions.

Undergraduate Teaching Assistant

Course: *PHYS 103 – Introductory Physics II*

🏛️ University of Arizona 📅 Aug 2019 – Dec 2019 📍 Tucson, AZ

- Oversaw problem solving sessions bi-weekly where I walked students through exam level practice problems.

TECHNICAL STRENGTHS

Strong:

Python, Mathematica, \LaTeX

Intermediate:

IRAF/PyRAF

Beginner:

C/C++, IDL

EXTRA-CIRRICULAR

Graduate Peer Mentor

University of Illinois Urbana Champaign

Grad On-Call

University of Illinois Urbana Champaign

Undergraduate Peer Mentor

University of Arizona

Physics Discovery Team Member & Project Developer

University of Arizona