Adam Michael Bauer

Graduate Research Assistant & Predoctoral Research Scientist

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RESEARCH INTERESTS

Nonlinear Dynamical Systems | **Climate Science** | **Social Cost of Carbon**

Extreme Heating Events | **Soil Moisture Dynamics** | **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*

SOURCES OF FUNDING

Graduate Research Fellowship

National Science Foundation | $102k | Aug 2022 – Aug 2025

Predoctoral Research Scientist Position

Columbia Business School & Tamer School of Social Enterprise | $15k | Apr 2022 – Jun 2022

REFEREED PUBLICATIONS

A. M. Bauer, L. R. Vargas Zeppetello, C. Proistosescu. On the impact of soil moisture on midlatitude temperature extremes. *In preparation*, 2022.

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. Kamienski, 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. *Accepted to The Astrophysical Journal*, 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 submillimeter giant arcs selected using Planck/Hershel. *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.)

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.
- Developed a conceptual framework highlighting the nonlinear interaction of soil moisture and temperature at the surface.
- Analytically derived a one-dimensional Hasselmann-like model for the soil moisture response to precipitation.
- Built a numerical simulation probing the impacts of soil moisture on the near-surface temperature distribution.
- **Outcome:** An in preparation publication.

TCREZClimate: Updating an integrated assessment model with an enhanced climate module

Advisor: *Prof. Cristian Proistosescu & Prof. Gernot Wagner*

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

- Rewrote and refactored EZClimate to include:
  - The *transient climate response to emissions* to calculate the temperature response to emissions;
  - An updated carbon cycle model;
  - Updated cost curves and damage functions in alignment with the recent IPCC WG2&3 reports.
- Probed the impact of the underlying uncertainty in both climate and economic parameters on the cost of carbon.

PAST RESEARCH PROJECTS

Using accretion physics to test general relativity

Advisor: *Prof. Nicolás Yunes & Prof. Charles F. Gammie*

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

- Performed analytic calculations of accretion flow properties for a generic 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 – May 2020 | 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

- 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.
- Fully funded NSF Research Experince for Undergraduates (REU).
- **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 telescope data.
- Used observational data to measure the redshift of galaxy cluster members and calculated the total mass of the cluster.
- 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.

PEDAGOGICAL RESEARCH

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 Dickenson, who performed my spring 2020 duties, in the spring 2021 semester.

TALKS AND PRESENTATIONS

Exploring the controls on temperature extremes in the midlatitudes

UC San Diego Climate Journal Club | May 2022 | San Diego, CA (Given virtually)

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 accepted – 2022-2025

List of Teachers Ranked as Excellent by Their Students
UIUC Department of Physics – 2020

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