

# Konstantin Gerbig

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## Research Interests

Planet formation theory; physics of protoplanetary disks; exoplanetary demographics and architectures; computational astrophysics; orbital dynamics; accretion disks; magneto-hydrodynamics: instabilities and turbulence; meteorology and atmospheric physics

## Education

### Yale University, Department of Astronomy

New Haven, CT, USA

PhD in Astronomy, Adviser: Gregory P. Laughlin (Yale)

2020 - present

Master of Science in Astronomy, Master of Philosophy in Astronomy

2022

### Ruprecht-Karls Universität Heidelberg

Heidelberg, BW, Germany

Master of Science, Physics, Advisers: Hubert Klahr (MPIA) & Ruth Murray-Clay (UCSC)

2017 - 2019

### Ruprecht-Karls Universität Heidelberg

Heidelberg, BW, Germany

Bachelor of Science, Physics, Advisers: Hubert Klahr (MPIA)

2013 - 2017

## Research Positions

### Yale University, Department of Astronomy

New Haven, CT, USA

Graduate Research Assistant

Sept 2020 - present

### Max Planck Institute for Astronomy

Heidelberg, BW, Germany

Research Assistant

2019 - 2020

### University of California, Santa Cruz, Department for Astronomy & Astrophysics

Santa Cruz, CA, USA

Junior Scientist

2018 - 2019

### Max Planck Institute for Astronomy

Heidelberg, BW, Germany

Student Researcher

2016 - 2018

## Publications

72 citations on ADS (65 lead-author) as of type-setting this CV; h-index = 3

### LEAD-AUTHOR

1. **Gerbig, K.**, Lin, M., & Lehmann, M., 2023, *Filament formation due to diffusive instabilities in dusty protoplanetary disks*, Submitted to the Astrophysical Journal (manuscript available upon request)
4. **Gerbig, K.**, & Li, R., 2023, *Planetesimal Initial Mass Functions following Diffusion regulated Gravitational Collapse*, The Astrophysical Journal, 949, 81
3. **Gerbig, K.**, & Laughlin, G., 2022, *The Prospects for Hurricane-like Vortices in Protoplanetary Disks*, The Astrophysical Journal, 930, 68
2. **Gerbig, K.**, Murray-Clay, R. A., Klahr, H. & Baehr, H., 2020, *Requirements for Gravitational Collapse in Planetesimal Formation – The Impact of Scales set by Kelvin-Helmholtz and Nonlinear Streaming Instability*, The Astrophysical Journal, 895, 91
1. **Gerbig, K.**, Lenz, C. T., & Klahr, H., 2019, *Linking Planetesimal and Dust Content in Protoplanetary Disks via a Local Toy Model*, Astronomy & Astrophysics, 629, A116

### CONTRIBUTED

3. Rice, M., **Gerbig, K.**, & Vanderburg, A., 2023, *The Joint Stellar Obliquity - Stellar Multiple Orientation Distribution*, Submitted to the Astrophysical Journal (manuscript available upon request)
2. Rice, M., Wang, S., **Gerbig, K.**, Wang, X., Dai, F., Tyler, D., Isaacson H., & Howard A., 2023, *The Orbital Architecture of Qatar-6: A Fully Aligned 3-Body System?*, The Astronomical Journal, 165, 65
1. Klahr, H., Delbo, M., & **Gerbig, K.**, 2022, *Constraining the Formation of MBAs: Timing of Formation and Initial Size-Frequency Distribution*, Simone Marchi. Vesta and Ceres: Insights into the Dawn of the Solar System, Chapter 13, p. 199

### IN ADVANCED PREPARATION

1. **Gerbig, K.**, Rice, M., & Zanazzi, J.J., 2023, *Dissipation during Binary-driven Recession of Protoplanetary Disks and its Implications on the Joint Stellar Obliquity – Binary Inclination Distribution*, in prep. (manuscript available upon request)

2. **Gerbig, K.**, Lu, T., Rice, M., Reynoso, J., Dong, J., Householder, A., & Laughlin, G., 2023, *Inclination Damping via Inelastic Planetesimal Collisions in Debris Disks with Binary Companion*, in prep. (manuscript available upon request)

## NON-REFEREED

1. Asali, Y, **Gerbig, K.**, Ghosh, A., Lindsay, C., Shen, Z., & Geha, M., 2022, *A Standardized Framework for Collecting Graduate Student Input in Faculty Searches*, Bulletin of the AAS 54(1), (equal first-authorship)

## Oral Presentations and Talks

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\*Virtual (via Zoom), † Upcoming as of type-setting this CV

### INVITED TALKS

† <b>University of California, Berkeley — Theoretical Astrophysics Center (TAC) Seminar</b>	Berkeley, CA, USA
Talk: <i>Modern planetesimal formation: From Diffusive Instabilities to Gravitational Collapse</i>	Oct 2023
† <b>Indiana University — Astrophysics Tea Talk</b>	Indianapolis, IN, USA
Talk: <i>Modern planetesimal formation: From Diffusive Instabilities to Gravitational Collapse</i>	Sep 2023
† <b>Cornell — Astrophysics Lunch</b>	Ithaca, NY, USA
Talk: <i>Modern planetesimal formation: From Diffusive Instabilities to Gravitational Collapse</i>	Sep 2023
<b>Academia Sinica, Institute for Astronomy and Astrophysics</b>	Taipei, Taiwan
Talk: <i>Planetesimal IMF following Diffusion Regulated Gravitational Collapse</i>	Apr 2023
<b>*University of Michigan — Stars, Planets, and Formation Journal Club</b>	Ann Arbor, MI, USA
Talk: <i>The Planetesimal Initial Mass Function</i>	Mar 2023
<b>*University of Arizona — Star &amp; Planet Formation Group Meeting</b>	Tucson, AZ, USA
Talk: <i>Planetesimal IMF following Diffusion Regulated Gravitational Collapse</i>	Feb 2023
<b>*CalTech — Yuk Lunch Seminar</b>	Pasadena, CA, USA
Talk: <i>Can Hurricane-like Vortices Exist in Protoplanetary Disks?</i>	Nov 2022
<b>Universitäts-Sternwarte München — Planet Formation Group Meeting</b>	Munich, Germany
Talk: <i>Hurricane-like Vortices in Protoplanetary Disks</i>	Aug 2022
<b>Other Worlds Laboratories 2022</b>	Santa Cruz, CA, USA
Talk: <i>Hurricane-like Vortices in Protoplanetary Disks</i>	July 2022
<b>*Planetesimal Formation Workshop</b>	virtual
Talk: <i>The Importance of Streaming Instability driven Particle Diffusion for Planetesimal Formation</i>	Nov 2020
<b>*Building Blocks of Planets Workshop</b>	virtual
Talk: <i>How Streaming and Kelvin-Helmholtz Instabilities can Regulate Planetesimal Formation</i>	Apr 2020
<b>Pebbles, Planetesimals and Protoplanets Workshop</b>	Ringberg, Germany
Talk: <i>Requirements for Gravitational Collapse in Planetesimal Formation</i>	Mar 2020
<b>University of California, Santa Cruz — Friday Lunch Time Astrophysics Seminar</b>	Santa Cruz, CA, USA
Talk: <i>Requirements for Gravitational Collapse in Planetesimal Formation</i>	Jan 2020
<b>CONTRIBUTED TALKS AND POSTERS</b>	
<b>2023 Northeast Star and Planet Formation Meeting, Center for Astrophysics</b>	Cambridge, MA, USA
Talk: <i>The Planetesimal Initial Mass Function from Diffusion-Limited Gravitational Collapse</i>	June 2023
<b>54th Meeting of the Division on Dynamical Astronomy</b>	East Lansing, MI, USA
Talk: <i>Precession-Driven Dissipation in Exoplanet-Hosting Binary Star Systems</i>	May 2023
<b>Athena++ workshop, CCA</b>	New York City, NY, USA
Talk: <i>Hurricane-like Vortices in Protoplanetary Disks</i>	May 2023
<b>Protostars and Planets VII</b>	Kyoto, Japan
Poster: <i>Predicting Planetesimal Initial Mass Functions following Diffusion Regulated Gravitational Collapse</i>	Apr 2023
<b>240th American Astronomical Society Meeting</b>	Pasadena, CA, USA
Talk: <i>Hurricane-like Vortices in Protoplanetary Disks</i>	June 2022
<b>Exoplanets IV</b>	Las Vegas, NV, USA
Poster: <i>The Prospects for Hurricane-like Vortices in Protoplanetary Disks</i>	May 2022
<b>*Exoplanets III</b>	virtual
Poster: <i>Requirements for Gravitational Collapse in Planetesimal Formation</i>	Jul 2020

## 235th American Astronomical Society Meeting

Poster: *Planetesimal Formation Regulated by Scales of Streaming and Kelvin-Helmholtz Instability*

Honolulu, HI, USA

Jan 2020

## Extreme Solar Systems IV

Poster: *How Scales of Streaming and Kelvin-Helmholtz Instabilities Regulate Particle Over-Densities and Planetesimal Formation*

Reykjavik, Iceland

Aug 2019

## 29th Bay Area Exoplanet Meeting

Talk: *How Scales of Streaming and Vertical Shear Instabilities Regulate Particle Over-Densities in Protoplanetary Disks*

Santa Cruz, CA, USA

Jun 2019

## Teaching

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### LECTURER

#### Dynamics

Assistant Lecturer at Reutlingen University

Reutlingen, BW, Germany

Spring 2020

#### Material Sciences

Assistant Lecturer at Reutlingen University

Reutlingen, BW, Germany

Spring 2020

#### Strength of Materials

Assistant Lecturer at Reutlingen University

Reutlingen, BW, Germany

Spring 2020

### TEACHING ASSISTANT

#### ASTR 160: Frontiers & Controversies in Astrophysics

Teaching Fellow at Yale University

New Haven, CT, USA

Fall 2022

#### ASTR 105: The Earth in its Cosmic Context

Teaching Fellow at Yale University

New Haven, CT, USA

Spring 2021

#### ASTR 110: Planets & Stars

Teaching Fellow at Yale University

New Haven, CT, USA

Fall 2021

#### ASTR 160: Frontiers & Controversies in Astrophysics

Teaching Fellow at Yale University

New Haven, CT, USA

Spring 2021

#### AY9: Introduction to Research in Astronomy & Astrophysics

Teaching Assistant at University of California, Santa Cruz

Santa Cruz, CA, USA

Spring 2019

#### Physics for Non-Physicists

Teaching Assistant at Heidelberg University

Heidelberg, BW, Germany

Spring 2018

#### Physics Lab

Lab Tutor at Heidelberg University

Heidelberg, BW, Germany

Fall 2017

#### Introductory Mathematics

Teaching Assistant at Heidelberg University

Heidelberg, BW, Germany

Spring 2016

## Media Coverage

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### A Grad Student Seat at the Faculty Hiring Table

Astrobites

Jan 2023

### What Hurricanes and Space Storms have in Common

Yale News, Q&A

Oct 2022

### Humans of Yale OISS

Humans of Yale OISS, Instagram of Yale Office of International Students and Scholars

Sep 2022

### The Calm Before the –Planet Formation?

AAS Nova

Jun 2022

### The Calm Before the –Planet Formation?

Astrobites

Apr 2022

## Advising and Mentoring Experience

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\* Primary research adviser

### SCIENTIFIC

**Yurou (Nina) Liu**, Yale University (undergraduate)

Project: *The Dynamical History of the two Hot Jupiters in the WASP-94 Binary System*

July 2023 - present

**\*Jeremiah Reynoso**, Morehouse College, SURF student (undergraduate)

Project: *Dissipation due to Inelastic Planesimal Collisions in Differentially Precessing Debris Disks*

June 2023 - present

**\*Aaron Householder**, Yale University (undergraduate)

Project: *Precessing Debris Disks with Binary Companion*

Sep 2022 - May 2023

**Vajie Liang**, Heidelberg University / MPIA (bachelor's student)

Project: *Gravitationally Unstable Disks in GIZMO*

Jan 2020 - Aug 2020

**Marco Vetter**, Heidelberg University / MPIA (bachelor's student)

Project: *Streaming Instability in Pressure Bumps*

Aug 2019 - May 2020

## PROFESSIONAL

### Yale Astronomy Siblings

'Big Sib' in Yale's graduate - undergraduate Astronomy mentoring program.

2020 - present

Mentees:

- Hanna Adamski (Yale class of 2024)
- Audrey Cesene (Yale class of 2024)

## Telescope Proposals

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**Keck Observatory (HIRES)**, 2 nights – CO-I

*Probing the Exoplanet Mass Discrepancy Between the Radial Velocity and Transit Timing Methods with the Anomalous Low Density Planet Sample and Keck-HIRES (Phase 2)*

Yale 2023A

**Keck Observatory (HIRES)**, 2 nights – CO-I

*Probing the Exoplanet Mass Discrepancy Between the Radial Velocity and Transit Timing Methods with the Anomalous Low Density Planet Sample and Keck-HIRES (Phase 1)*

Yale 2022B

## Service

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### PROFESSIONAL

#### Lead Conference Organizer — ERES 2023

Emerging Researchers in Exoplanet Science conference hosted at Yale University in June 2023

Nov 2022 - present

- Chair of Science Organizing Committee: Developed and oversaw double blind review of abstracts, coordinated the distribution of abstracts to reviewers, compiled scientific program schedule, organized 100+ poster and oral presentations, lead communicator with science presenters
- Ethics Committee: Authored conference code of conduct. Contact person for reporting breaches of the code of conduct.
- Communication & PR committee: Authored conference FAQ, management of the conference Slack workspace, successful advertisement of the conference to 160 initial registrants.

#### Reviewer

The Astrophysical Journal

2023 - present

#### Seminar Organizer

Yale Exoplanet & Stars Seminar

2023 - present

Co-Organizer and Coordinator of Yale's weekly Exoplanet and Stars seminar

#### Co-author

Yale Astronomy Newsletter 2022

Dec 2022

- Article on Dorrit Hoffleit and the Dorrit Hoffleit fellowship at Yale
- Profile piece on Debra Fisher

#### Yale Graduate Student Assembly

Elected representative for Astronomy at Yale's Graduate Student Assembly

2022 - present

- Academic and professional development committee
- Biweekly general assembly meetings

#### Astrobites Collaboration

Service within the Astrobites Collaboration

2022 - present

- Scheduling committee co-chair
- Climate change committee

## Astronomy Student Council

Elected member of Yale's Astronomy Student Council

2021 - present

- Involved in efforts to make the Yale Astronomy graduate program fairer, more equitable and more accessible
- Coordination of all graduate meetings
- Development of a procedure to solicit graduate feedback in faculty searches, and coordination of its implementation during two faculty hire processes at Yale Astronomy, see the corresponding publication in the Bulletin of the American Astronomical Society: *A Standardized Framework for Collecting Graduate Student Input in Faculty Searches*, Bulletin of the AAS 2022, 54(1)

## Astronomy Climate and Diversity Committee

Member of Yale's Astronomy Climate and Diversity Committee

2020 - 2021

## COMMUNITY ENGAGEMENT

### Yale Salsa Society Leadership

Co-leadership position in Yale's Salsa Society

2023 - present

- Bachata and salsa dance instructor
- Organization of events, and advertisement

## Outreach

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### Volunteer at Yale Openlabs

Local outreach organization dedicated to educating middle school children on STEM topics

Mar 2023

Seton Elm-Ivy Award Recipient. Presentation: *Planets in our Solar System and Beyond*

### Speaker for Astronomy on Tap, New Haven

Outreach program aimed at engaging local community with current astronomy research

Nov 2022

Talk: *Mysteries of Planet Formation*

### Astrobites Author and Editor

The Astrobites collaboration is a graduate student outreach organization with the goal of increasing accessibility to undergraduate students in the physical sciences

2022 - present

I authored the following Astrobites articles:

- The First Directly Imaged Binary System with Substellar Siblings
- The Kozai-Lidov Tango: The Ups and Downs of being a Polar Circumbinary Disk
- Using tides to peek into asteroid interiors
- Diffusion and depletion of carbon monoxide in disks
- Understanding the surprising narrowness of eccentric debris belts
- Young, cool, and on edge — an unstable protoplanetary disk
- Strategies for Forming Research Talk Questions
- (Mis)alignment Between Exoplanets and Binary Stars
- Don't (Forget To) Look Up

## Technical Skills

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**Programming** Proficient: Python,  $\text{\LaTeX}$ ; Working knowledge: C/C++, Git, Fortran, HTML, JavaScript, R

**MHD Codes** Athena++, Pencil, Athena

**HPC** Experience with high performance computing facilities of the Max-Planck Society and at Yale

## References

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### Greg Laughlin

Professor, Dept. of Astronomy, Yale University

Address: Department of Astronomy, Yale University, PO Box 208101, New Haven, CT 06520-8101, USA

Email: greg.laughlin@yale.edu

### Ruth Murray-Clay

Professor, Dept. of Astronomy, University of California, Santa Cruz

Address: Department of Astronomy & Astrophysics, University of California, Santa Cruz, 1156 High Street, Santa Cruz, CA 95064, USA

Email: rmc@ucsc.edu

### Malena Rice

Assistant Professor, Dept. of Astronomy, Yale University

Address: Department of Astronomy, Yale University, PO Box 208101, New Haven, CT 06520-8101, USA

Email: malena.rice@yale.edu

**Min-Kai Lin (林明楷)**

Associate Research Fellow (Tenured), Academia Sinica, Institute for Astronomy and Astrophysics

Address: Academia Sinica, Institute for Astronomy and Astrophysics, No.1, Sec. 4, Roosevelt Rd, Taipei 10617, Taiwan, R.O.C.

Email: mklin@asiaa.sinica.edu.tw

**Hubert Klahr**

Professor, Max-Planck Insitute for Astronomy, Heidelberg University

Address: Max-Planck Insitut für Astronomie, Königstuhl 17, 69117 Heidelberg, Germany

Email: klahr@mpia.de