

# Sabrina Marbut Appel

NSF Astronomy & Astrophysics Postdoctoral Fellow  
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## APPOINTMENTS

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2024 - Present      **NSF Astronomy & Astrophysics Postdoctoral Fellow**  
American Museum of Natural History (AMNH), New York, NY

## EDUCATION

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2018 - 2024      **Rutgers, The State University of New Jersey**, Piscataway, NJ  
Ph.D. in Physics and Astronomy, 2024  
M.S. in Physics and Astronomy, 2022  
Thesis Title: “Exploring the Effect of Protostellar Feedback on  
Star Formation and Molecular Cloud Dynamics”  
Thesis Defense: Jun. 20, 2024  
Thesis Advisor: Dr. Blakesley Burkhart

2013 - 2017      **Reed College**, Portland, OR  
B.A. in Physics, 2017  
Senior Thesis: “Simulating the Gravitational Lensing of Massive  
Particles: An Exploration of Scattering Solutions of the  
Schwarzschild Metric”  
Senior Thesis Advisor: Dr. Andrew Larkoski

2009 - 2013      **South Salem High School**, Salem, OR  
International Baccalaureate Diploma, 2013

## OTHER RESEARCH EXPERIENCE

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Summer 2016      **American Museum of Natural History**  
NSF Funded REU Participant, Advised by Dr. Dave Zurek

Summer 2015      **Rutgers, The State University of New Jersey**  
NSF Funded REU Participant, Advised by Dr. Andrew Baker

## GRANTS

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2024 - 2027      PI for the **NSF AAPF** Proposal “Exploring the Impact of Protostellar  
Jets in Star Cluster Formation and Evolution”, Awarded for Sep. 1,  
2024 to Aug. 31, 2027 and hosted at AMNH

2023 Collaborator on the **NSF Proposal** “The Untimely Deaths of Star Clusters”, submitted Fall 2022, awarded Fall 2023

## SCHOLARSHIPS, HONORS, AND AWARDS

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Fall 2023	<b>Noemie Koller Scholarship</b> , Rutgers Physics and Astronomy Department
Summer 2023	<b>SGS Travel Award</b> , Rutgers School of Graduate Studies, awarded for participation in the “Olympian Symposium”
Summer 2022	<b>Torrey Fellowship</b> , Rutgers Physics and Astronomy Department
Spring 2022	<b>Peter Lindendorf Graduate Fellowship</b> , Rutgers Physics and Astronomy Department
Summer 2019	<b>Boyd Scholarship</b> , Rutgers Physics and Astronomy Department
Summer 2019	<b>Travel Award</b> , Rutgers Physics and Astronomy Department, awarded for travel to the “Advancing Theoretical Astrophysics Summer School”
2017	<b>Phi Beta Kappa</b> , inducted to the Reed College Chapter May 15, 2017
2014 - 2017	<b>NSF Scholar</b> , awarded by Reed College for the 2014/15, 2015/16, and 2016/17 academic years
2013 - 2017	<b>President’s Commendation for Academic Excellence</b> , Reed College, awarded for academic performance in the 2013/14, 2014/15, 2015/16 and 2016/17 academic years
2013 - 2017	<b>Reed College Grant</b> , Reed College Financial Aid Office, awarded for the 2013/14, 2014/15, 2015/16, and 2016/17 academic years

## STUDENT MENTORING

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2025 to present	<b>Fred Javier</b> , AMNH Physical Sciences REU Student (Summer 2025) & Ongoing collaboration, AMNH, New York, NY
2021 - 2022	<b>Avery Kiihne</b> , Undergraduate Researcher, Summer 2021 - Summer 2022, Rutgers, The State University of New Jersey, Piscataway, NJ

## SERVICE

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2025 to present	<b>Seminar Committee</b> , AMNH, New York, NY
2024 to present	<b>Paper Referee</b> Astronomy & Astrophysics (A&A)
2020 - 2024	<b>Leadership Roles in MiPA</b> (Minorities in Physics and Astronomy group), Rutgers, the State University of New Jersey, Piscataway, NJ
	<b>Past President</b> - Sep. 2023 to Aug. 2024
	<b>President</b> - Dec. 2022 to Sep. 2023
	<b>Graduate Chair</b> - Summer 2020 to Dec. 2022
	<b>Co-Coordinator of EIJC</b> (See below) - 2020 to 2022

2020	Led the creation of a MiPA Charter and Code of Conduct (2020) <b>Founder of the Equity and Inclusion Journal Club (EIJC)</b> , Rutgers, the State University of New Jersey, Piscataway, NJ
2019 - 2020	<b>Officer of Women in Physics and Astronomy (WiPA)</b> , Rutgers, the State University of New Jersey, Piscataway, NJ Co-led the effort to establish weekly meetings Co-led the transition from Women in Physics and Astronomy to Minorities in Physics and Astronomy (Spring and Summer 2020)
2019 - 2020	<b>Co-President of the Physics and Astronomy Graduate Student Organization</b> , Rutgers, the State University of New Jersey, Piscataway, NJ

## OUTREACH AND TEACHING (SELECTED)

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Oct. 21, 2024	<b>Guest Presentation:</b> “Using Computational Astrophysics to Understand Star Formation,” Visit to Computational Astrophysics Course including a talk, Rutgers, the State University of New Jersey, New Brunswick, NJ
Fall 2022	<b>Teaching Assistant</b> , <i>Computational Astrophysics</i> , Rutgers, The State University of New Jersey, Piscataway, NJ
Fall 2020	<b>Teaching Assistant</b> , <i>Byrne Seminar: The Rutgers Undergraduate Pipeline to Research &amp; Education in Physics (RU-PREP)</i> , Rutgers, The State University of New Jersey, Piscataway, NJ Includes being available as a mentor for the students
Spring 2019	<b>Teaching Assistant</b> , <i>Extended Analytical Physics II</i> , Rutgers, The State University of New Jersey, Piscataway, NJ
Fall 2018	<b>Teaching Assistant</b> , <i>Extended Analytical Physics I</i> , Rutgers, The State University of New Jersey, Piscataway, NJ
Fall 2017 - Summer 2018	<b>Volunteer</b> , Physics Lab & Featured Exhibits, Oregon Museum of Science and Industry, Portland, OR
Fall 2014 - Spring 2017	<b>Teaching Assistant</b> , <i>Introductory Physics Laboratory</i> , Reed College, Portland, OR
Fall 2014 - Spring 2015	<b>Drop-in Tutor</b> , <i>Introductory Physics</i> , Reed College, Portland, OR
Summer 2014	<b>Library Intern</b> , Salem Public Library’s Children’s Desk, Salem, OR
Fall 2013 - Spring 2014	Math and Reading <b>Tutor</b> , Grout Elementary School, Portland, OR

## CONFERENCE ORGANIZATION

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2024	LOC for the <b>Advanced AMUSE Workshop</b> , American Museum of Natural History, New York, NY, (Apr. 22-26, 2024)
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- 2022 Head of the SOC and LOC for the **Torch Regional Meeting**, Center Computational Astrophysics, Flatiron Institute, New York, NY, (Oct. 21, 2022)
- 2022 Head of the SOC and LOC for the **Torch Workshop**, Center Computational Astrophysics, Flatiron Institute, New York, NY, (Aug. 17-19, 2022)

## TALKS (SELECTED)

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- Jul. 17, 2025 “Exploring Protostellar Jets in Star Cluster Formation with Torch,” Interstellar Institute 7: A three week scientific session at Institut Pascal, Paris-Saclay, France
- May 28, 2025 **Invited Talk:** “The Cycle of Star Formation across Scales: Stellar Feedback as a Source of Interstellar Turbulence,” Star Formation, Stellar Feedback, and the Ecology of Galaxies, Visegrád, Hungary
- Jan. 15, 2025 “Exploring the Role of Protostellar Jets in Simulations of Star Cluster Formation using Torch,” Oral Session of the AAS 245 Winter Meeting, National Harbor, MD
- Jan. 12, 2025 “Exploring the Impact of Protostellar Jets in Star Cluster Formation and Evolution,” NSF AST Fellow Symposium, AAS 245 Winter Meeting, National Harbor, MD
- Dec. 12, 2024 “The Impact of Protostellar Jets in Star Cluster Formation Simulations,” CICO-VICO-CCA Origins Workshop, Center for Computational Astrophysics, Flatiron Institute, New York, NY
- Sep. 17, 2024 **Invited Talk:** “Star Formation at the Cloud-Scale: Understanding the Density Distribution and the Gas Dynamics,” KITP: Cosmic Origins: The First Billion Years, UC Santa Barbara, Santa Barbara, CA
- Jun. 20, 2024 “Exploring the Effect of Protostellar Feedback on Star Formation and Molecular Cloud Dynamics,” Ph.D. Thesis Defense, Rutgers, The State University of New Jersey, Piscataway, NJ
- Mar. 21, 2024 “Exploring the Star Formation Rate and the Effect of Protostellar Feedback at the Cloud-scale,” Thursday Seminar, Columbia University, New York, NY
- Jan. 11, 2024 “The Density Distribution and the Gas Compression and Expansion Rates of Molecular Clouds: Understanding the Star Formation Rate and Exploring the Effect of Protostellar Feedback,” **Dissertation Talk** at the 243rd AAS Meeting, New Orleans, LA
- Jun. 28, 2023 “How the Gas Dynamics Set the Star Formation Rate of Molecular Clouds,” The 2023 Northeast Star and Planet Formation Meeting, Center for Astrophysics (CfA), Cambridge, MA
- Jun. 2, 2023 “How the Gas Dynamics Set the Star Formation Rate of Molecular Clouds,” The Olympian Symposium, Paralia Katerini, Mt. Olympus, Greece

May 26, 2023	<b>Invited Talk:</b> “How the Gas Dynamics Set the Star Formation Rates of Molecular Clouds,” Young MMF talk at the Midwest Magnetic Fields Workshop 2023, Online
Apr. 20, 2023	<b>Invited Talk:</b> “How the Gas Dynamics Set the Star Formation Rates of Molecular Clouds,” Princeton Thunch Series, Princeton University, Princeton, NJ
Mar. 21, 2023	<b>Invited Talk:</b> “How the Gas Dynamics Set the Star Formation Rates of Molecular Clouds,” KITP: Conference on Galaxy Formation and Evolution in the Data Science Era, UC Santa Barbara, Santa Barbara, CA
Aug. 23, 2022	“The Impact of Stellar Feedback on the Dynamics and Evolution of Star Forming Regions,” the Clusters Workshop at McMaster University, Hamilton, Ontario, Canada
Aug. 18, 2022	“Implementing Protostellar Outflows in TORCH,” the Summer 2022 TORCH Workshop, Center Computational Astrophysics, Flatiron Institute, New York, NY
Jul. 21, 2022	“The Impact of Stellar Feedback on the Dynamics and Evolution of Star Forming Regions,” With Two Eyes: A three week scientific session of the Interstellar Institute, Institut Pascal, Paris-Saclay, France
Dec. 9, 2022	“The Impact of Stellar Feedback on the Density PDF in Star Forming Regions,” VICO-CICO Fall 2021 Workshop, University of Virginia, Charlottesville, VA
Dec. 3, 2021	“The Impact of Stellar Feedback on the Density PDF in Star Forming Regions,” The Mid-Atlantic Section of the APS Meeting, Rutgers, The State University of New Jersey, Piscataway, NJ
2019 - 2021	“Women in Physics: A Case Study of Equity Issues in Physics,” Student Seminar in Physics and Astronomy, Rutgers, The State University of New Jersey, Piscataway, NJ (joint talk with Charlotte Olsen) Gave the same talk Mar. 14, 2019, Nov. 21, 2019, Oct. 22, 2020 (Online), and Dec. 2, 2021 (Online)
Jul. 26, 2021	“Towards an Analytic Model of Star Formation: What Makes Star Formation Inefficient?” Interstellar Institute’s program “The Grand Cascade”, Paris-Saclay University’s Institut Pascal, Online
Dec. 14, 2020	“Towards an Analytic Model of Star Formation: What Makes Star Formation Inefficient?” CICO-VICO Fall 2020 Workshop, Online
Sep. 6, 2019	“Investigating the Impact of Stellar Feedback on Models of Star Formation,” Gotham Fest 2019, Simons Foundation Center for Computational Astrophysics, New York, NY
May 2, 2017	“Simulating Gravitational Lensing,” Senior Thesis Oral Examination, Reed College, Portland, OR 2-hour exam before an interdisciplinary, 4-person board of faculty

## POSTERS AND OTHER PRESENTATIONS

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- Apr. 15-19, 2024 “Exploring the Star Formation Rate and the Effect of Protostellar Feedback at the Cloud-scale,” Poster, **2024 Spring Symposium – Recipes to Regulate Star Formation at All Scales: From the Nearby Universe to the First Galaxies**, STScI, Baltimore, MD
- Jun. 20-24, 2022 “The Impact of Stellar Feedback on the Dynamics and Evolution of Star Forming Regions,” Poster, **From Stars to Galaxies II**, Chalmers University, Gothenberg, Sweden
- Jun. 1-3, 2020 “Investigating the Impact of Stellar Feedback on Models of Star Formation,” iPoster, The **236th AAS Meeting**, Online
- Jan. 6, 2017 “From the Ultraviolet to the Infrared: The Stars of M70,” Poster, **229th AAS Meeting**, Grapevine, TX
- Jan 6, 2016 “Star Formation in Nearby Analogues of Lyman Break Galaxies,” Poster, **227th AAS Meeting**, Kissimmee, FL

## MEMBERSHIPS AND ACTIVITIES (SELECTED)

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- 2015 - Present **American Astronomical Society (AAS)**  
Junior Member Fall 2015 to Fall 2017 *and* Feb. 2020 to Dec. 2024  
Full Member Dec. 2024 to Present
- 2015 - 2018 **American Physical Society (APS)**, Member Fall 2015 to Fall 2018

## MEETINGS, CONFERENCES, AND WORKSHOPS (SELECTED)

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- Sept. 9-20, 2024 **KITP: Cosmic Origins: The First Billion Years**, Program Participant, UC Santa Barbara, Santa Barbara, CA
- Apr. 22-26, 2024 **Advanced AMUSE Workshop**, American Museum of Natural History, New York, NY
- Jan. 6, 2024 **Peer Review Workshop**, 243rd AAS Meeting, New Orleans, LA
- Apr. 5, 2023 Spring 2023 **TORCH Regional Meeting**, American Museum of Natural History, New York, NY
- Oct. 21, 2022 Fall 2022 **TORCH Regional Meeting**, Center Computational Astrophysics, Flatiron Institute, New York, NY
- Aug. 22-24, 2022 **Clusters Workshop at McMaster University**, Hamilton, Ontario, Canada
- Aug. 17-19, 2022 Summer 2022 **TORCH Workshop**, Center Computational Astrophysics, Flatiron Institute, New York, NY
- Jun. 7-9, 2021 The **238th AAS Meeting**, Virtual
- Jan. 17, 2020 **New England Star Formation Meeting**, University of Connecticut, Storrs, CT

Aug. 28-30, **Torch Open Source Workshop: Introduction to Structure and Use**, Simons Foundation Center for Computational Astrophysics, New York, NY  
2019  
Jul. 15-26, 2019 **Advancing Theoretical Astrophysics** Summer School, University of Amsterdam, Amsterdam, The Netherlands

## OTHER EXPERIENCE

Jul. 10, 2017 to Technical Consultant, Kolisch Hartwell, P.C., Portland, OR  
May 31, 2018

## PUBLICATIONS

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† - indicates an undergraduate student mentee

**Appel, S. M.**, Burkhart, B., Mac Low, M.-M., Andersson, E. P., Cournoyer-Cloutier, C., Lewis, S., McMillan, S. L. W., Polak, B., Portegies Zwart, S., Tran, A., & Wilhelm, M. J. C., “*Protostellar Jets in Star Cluster Formation and Evolution: I. Implementation and Initial Results*”, 2025, arXiv e-prints, arXiv:2509.15311, (doi: [10.48550/arXiv.2509.15311](https://doi.org/10.48550/arXiv.2509.15311)).

- Primary author; led the code development, performed and analyzed the simulations used, wrote the manuscript, and led the editing and submission of the manuscript.

Cournoyer-Cloutier, C., Andersson, E. P., **Appel, S. M.**, Lahén, N., Polak, B., Rantala, A., Toonen, S., Sills, A., Rieder, S., Portegies Zwart, S., Mac Low, M.-M., & Harris, W. E., “*Massive Interacting Binaries Enhance Feedback in Star-forming Regions*”, 2025, ApJ, 990, 112, (doi: [10.3847/1538-4357/ade0f1](https://doi.org/10.3847/1538-4357/ade0f1)).

- Member of the Torch collaboration; regularly attended group meetings; contributed comments and edits to the manuscript.

Polak, B., Mac Low, M.-M., Klessen, R. S., Portegies Zwart, S., Andersson, E. P., **Appel, S. M.**, Cournoyer-Cloutier, C., Glover, S. C. O., & McMillan, S. L. W., “*Massive star cluster formation: III. Early mass segregation during cluster assembly*”, 2025, A&A, 695, A188, (doi: [10.1051/0004-6361/202451785](https://doi.org/10.1051/0004-6361/202451785)).

- Member of the Torch collaboration; regularly attended group meetings; contributed comments and edits to the manuscript.

†Kiihne, A., **Appel, S. M.**, Burkhart, B., Semenov, V. A., & Federrath, C., “*Fitting Methods for Probability Distribution Functions in Turbulent Star-forming Clouds*”, 2025, ApJ, 979, 89, (doi: [10.3847/1538-4357/ad99d5](https://doi.org/10.3847/1538-4357/ad99d5)).

- Mentor to the first author, including supporting them during development of the project, analysis, writing the manuscript, and the review process.

Cournoyer-Cloutier, C., Sills, A., Harris, W. E., Polak, B., Rieder, S., Andersson, E. P., **Appel, S. M.**, Mac Low, M.-M., McMillan, S., & Portegies Zwart, S., “*Massive Star Cluster Formation with Binaries. I. Evolution of Binary Populations*”, 2024, ApJ, 977, 203, (doi: [10.3847/1538-4357/ad90b3](https://doi.org/10.3847/1538-4357/ad90b3)).

- Member of the Torch collaboration; regularly attended group meetings; contributed comments and edits to the manuscript.

Polak, B., Mac Low, M.-M., Klessen, R. S., Portegies Zwart, S., Andersson, E. P., **Appel, S. M.**, Cournoyer-Cloutier, C., Glover, S. C. O., & McMillan, S. L. W., “*Massive star cluster formation: II. Runaway stars as fossils of subcluster mergers*”, 2024, A&A, 690, A207, (doi: [10.1051/0004-6361/202450774](https://doi.org/10.1051/0004-6361/202450774)).



- Member of the Torch collaboration; regularly attended group meetings; contributed comments and edits to the manuscript.

Polak, B., Mac Low, M.-M., Klessen, R. S., Wei Teh, J., Cournoyer-Cloutier, C., Andersson, E. P., **Appel, S. M.**, Tran, A., Lewis, S. C., Wilhelm, M. J. C., Portegies Zwart, S., Glover, S. C. O., Rieder, S., Wang, L., & McMillan, S. L. W., “*Massive star cluster formation: I. High star formation efficiency while resolving feedback of individual stars*”, 2024, A&A, 690, A94, (doi: [10.1051/0004-6361/202348840](https://doi.org/10.1051/0004-6361/202348840)).

- Member of the Torch collaboration; regularly attended group meetings; contributed comments and edits to the manuscript.

**Appel, S. M.**, Burkhart, B., Semenov, V. A., Federrath, C., Rosen, A. L., & Tan, J. C., “*What Sets the Star Formation Rate of Molecular Clouds? The Density Distribution as a Fingerprint of Compression and Expansion Rates*”, 2023, ApJ, 954, 93, (doi: [10.3847/1538-4357/ace897](https://doi.org/10.3847/1538-4357/ace897)).

- Primary author; performed most of the analysis and did most of the writing for the manuscript.

Cournoyer-Cloutier, C., Sills, A., Harris, W. E., **Appel, S. M.**, Lewis, S. C., Polak, B., Tran, A., Wilhelm, M. J. C., Mac Low, M.-M., McMillan, S. L. W., & Portegies Zwart, S., “*Early evolution and three-dimensional structure of embedded star clusters*”, 2023, MNRAS, 521, 1338-1352, (doi: [10.1093/mnras/stad568](https://doi.org/10.1093/mnras/stad568)).

- Member of the Torch collaboration; regularly attended group meetings; contributed comments and edits to the manuscript.

**Appel, S. M.**, Burkhart, B., Semenov, V. A., Federrath, C., & Rosen, A. L., “*The Effects of Magnetic Fields and Outflow Feedback on the Shape and Evolution of the Density Probability Distribution Function in Turbulent Star-forming Clouds*”, 2022, ApJ, 927, 75, (doi: [10.3847/1538-4357/ac4be3](https://doi.org/10.3847/1538-4357/ac4be3)).

- Primary author; performed most of the analysis and did most of the writing for the manuscript.

Burkhart, B., **Appel, S. M.**, Bialy, S., Cho, J., Christensen, A. J., Collins, D., Federrath, C., Fielding, D. B., Finkbeiner, D., Hill, A. S., Ibáñez-Mejía, J. C., Krumholz, M. R., Lazarian, A., Li, M., Mocz, P., Mac Low, M.-M., Naiman, J., Portillo, S. K. N., Shane, B., Slepian, Z., & Yuan, Y., “*The Catalogue for Astrophysical Turbulence Simulations (CATS)*”, 2020, ApJ, 905, 14, (doi: [10.3847/1538-4357/abc484](https://doi.org/10.3847/1538-4357/abc484)).

- Contributing numerical simulations from Torch.