

# Minghao Guo

## PERSONAL INFORMATION

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| Name:     |  Minghao Guo (郭明浩)             | Address: |  Peyton Hall, Princeton University,<br>Princeton, NJ 08544, USA |
| Email:    |  mhguo@princeton.edu           | GitHub:  |  mh-guo   |
| Homepage: |  mh-guo.github.io              | GitLab:  |  mhguo  |
| ORCID:    |  orcid.org/0000-0002-3680-5420 |          |   |

## EDUCATION

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|---|----------------------|
| <b>Princeton University</b>   | Princeton, US        |
| Graduate Student, Department of Astrophysical Sciences                        | 2021 – Expected 2026 |
| • Thesis: Multiscale multiphase modeling of black hole accretion and feedback |                      |
| <b>Princeton University</b>   | Princeton, US        |
| Master of Arts, Department of Astrophysical Sciences                          | 2021 – 2023          |
| <b>Peking University</b>  | Beijing, CN          |
| Bachelor of Science in Physics, Yuanpei College                               | 2016 – 2021          |
| • Thesis: A numerical study of scalar-tensor gravity theory                   |                      |

## EXPERIENCE

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|   |                           |
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| <b>Institute for Advanced Study</b>                   | Princeton, US             |
| Visiting Graduate Student, School of Natural Sciences | Dec. 2023 – Expected 2026 |

## RESEARCH INTERESTS

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- Black holes, high energy astrophysics, accretion disk, general relativistic magnetohydrodynamics (GRMHD)
- Active galactic nuclei (AGN), galaxy formation and evolution, multiphase interstellar medium (ISM)
- Numerical methods and simulations, GPU computing, new numerical techniques
- Neutron stars, pulsars, gravitational waves, modified gravity theory

## PUBLICATIONS

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See [ADS](#), [Google Scholar](#), or [ORCID](#) for full list. First-author citations: 149

1. **Minghao Guo**, James M. Stone, Eliot Quataert, and Volker Springel, “Cyclic Zoom: Multiscale GRMHD Modeling of Black Hole Accretion and Feedback,” [ApJ 987, 202 \(2025\)](#), [arXiv:2504.16802 \[astro-ph.HE\]](#) .
2. **Minghao Guo**, Eliot Quataert, Jonathan Squire, Philip F. Hopkins, and James M. Stone, “Idealized Global Models of Accretion Disks with Strong Toroidal Magnetic Fields,” [arXiv e-prints](#) , [arXiv:2505.12671 \(2025\)](#), [arXiv:2505.12671 \[astro-ph.HE\]](#) .
3. **Minghao Guo**, Chang-Goo Kim, and James M. Stone, “Evolution of Supernova Remnants in a Cloudy Multiphase Interstellar Medium,” [ApJ 990, 49 \(2025\)](#), [arXiv:2411.12809 \[astro-ph.GA\]](#) .
4. **Minghao Guo**, James M. Stone, Eliot Quataert, and Chang-Goo Kim, “Magnetized Accretion onto and Feedback from Supermassive Black Holes in Elliptical Galaxies,” [ApJ 973, 141 \(2024\)](#), highlighted in [@PlotAstro](#), [arXiv:2405.11711 \[astro-ph.HE\]](#) .
5. **Minghao Guo**, James M. Stone, Chang-Goo Kim, and Eliot Quataert, “Toward Horizon-scale Accretion onto Supermassive Black Holes in Elliptical Galaxies,” [ApJ 946, 26 \(2023\)](#), highlighted in [AAS Nova](#), [arXiv:2211.05131 \[astro-ph.HE\]](#) .

6. **Minghao Guo**, Junjie Zhao, and Lijing Shao, “Extended reduced-order surrogate models for scalar-tensor gravity in the strong field and applications to binary pulsars and gravitational waves,” *PhRvD* **104**, 104065 (2021), arXiv:2106.01622 [gr-qc] .
7. **Minghao Guo**, Kohei Inayoshi, Tomonari Michiyama, and Luis C. Ho, “Hunting for Wandering Massive Black Holes,” *ApJ* **901**, 39 (2020), arXiv:2006.08203 [astro-ph.HE] .
8. **Minghao Guo**, Min Du, Luis C. Ho, Victor P. Debattista, and Dongyao Zhao, “A New Channel of Bulge Formation via the Destruction of Short Bars,” *ApJ* **888**, 65 (2020), arXiv:1911.07002 [astro-ph.GA] .
9. Hai-Yang Wang, **Minghao Guo**, Elias R. Most, Philip F. Hopkins, and Areteios Lalakos, “Galactic-scale Feeding Reveals Warped Hypermagnetized Multiphase Circumbinary Accretion Around Supermassive Black Hole Binaries,” *arXiv e-prints* , arXiv:2504.03874 (2025), arXiv:2504.03874 [astro-ph.HE] .
10. Rebecca Diesing, **Minghao Guo**, Chang-Goo Kim, James Stone, and Damiano Caprioli, “Nonthermal Signatures of Radiative Supernova Remnants,” *ApJ* **974**, 201 (2024), arXiv:2404.15396 [astro-ph.HE] .
11. Julie Hlavacek-Larrondo, Hyunseop Choi, **Minghao Guo**, Annabelle Richard-Laferrière, Carter Rhea, Marine Prunier, Helen Russell, Andy Fabian, Jonelle L. Walsh, Marie-Joëlle Gingras, Brian McNamara, Steve Allen, André-Nicolas Chené, Alastair Edge, Marie-Lou Gendron-Marsolais, Michael McDonald, Priyamvada Natarajan, Jeremy Sanders, James F. Steiner, Benjamin Vigneron, and Anja von der Linden, “Hubble Space Telescope Observations within the Sphere of Influence of the Powerful Supermassive Black Hole in PKS 0745-191,” *ApJ* **980**, 170 (2025), arXiv:2501.03339 [astro-ph.GA] .
12. James M. Stone, Patrick D. Mullen, Drummond Fielding, Philipp Grete, **Minghao Guo**, Philipp Kempinski, Elias R. Most, Christopher J. White, and George N. Wong, “AthenaK: A Performance-Portable Version of the Athena++ AMR Framework,” *arXiv e-prints* , arXiv:2409.16053 (2024), arXiv:2409.16053 [astro-ph.IM] .
13. Rajsekhar Mohapatra, Eliot Quataert, Drummond Fielding, and **Minghao Guo**, “The Type Ia Supernova and Asymptotic Giant Branch Stellar Ejecta-regulated Interstellar Medium of Massive Galaxies,” *ApJ* **989**, 103 (2025), arXiv:2502.05329 [astro-ph.GA] .

## APPROVED PROPOSALS

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|   |                       |
|---|-----------------------|
| <b>EuroHPC</b> (PI: Volker Springel)  | ~ 1 M GPU hours       |
| Multi-scale (GR)MHD modelling of accretion onto supermassive black holes              | Mar. 2024 – Jun. 2025 |
| <b>NSF ACCESS Maximize</b> (PI: Eliot Quataert)                                       | ~ 100 k GPU hours     |
| Investigating stellar and black hole heating in massive galaxies, groups and clusters | Oct. 2024 – Sep. 2025 |
| <b>JWST Cycle 3</b> (PI: Julie Hlavacek-Larrondo)                                     | ~ 6 hours             |
| Mapping a Black Hole Accretion Flow with JWST/NIRSpec                                 | 2024 – 2025           |
| <b>NSF ACCESS Accelerate</b> (PI: James M. Stone)                                     | ~ 42 k GPU hours      |
| Multiscale GRMHD Modeling of Accretion onto Supermassive Black Holes                  | Nov. 2023 – Feb. 2025 |
| <b>NSF ACCESS Explore</b> (PI: Minghao Guo)   | ~ 10 k GPU hours      |
| Multi-scale MHD Modeling of Accretion onto Supermassive Black Holes                   | Jun. 2023 – Jun. 2024 |

## REFERENCES

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|--|------------------------------|
| <b>Charles A. Young Professor of Astronomy, Eliot Quataert</b><br>quataert@princeton.edu | Princeton University         |
| <b>Professor James M. Stone</b><br>jmstone@ias.edu                                       | Institute for Advanced Study |

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| <b>Prof. Dr. Volker Springel</b><br><a href="mailto:vspringel@mpa-garching.mpg.de">vspringel@mpa-garching.mpg.de</a> | Max Planck Institute for Astrophysics |
| <b>Ira S. Bowen Professor, Philip F. Hopkins</b><br><a href="mailto:phopkins@caltech.edu">phopkins@caltech.edu</a>   | California Institute of Technology    |
| <b>Director, Chair Professor Luis C. Ho</b><br><a href="mailto:lho.pku@gmail.com">lho.pku@gmail.com</a>              | Peking University                     |
| <b>Professor Kohei Inayoshi</b><br><a href="mailto:inayoshi.pku@gmail.com">inayoshi.pku@gmail.com</a>                | Peking University                     |
| <b>Professor Lijing Shao</b><br><a href="mailto:lshao@pku.edu.cn">lshao@pku.edu.cn</a>                               | Peking University                     |

## HONORS AND AWARDS

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|  |           |
|--|-----------|
| Princeton First Year Fellowship in Natural Science & Engineering | 2021      |
| Weiming Bachelor, Peking University                              | Jun. 2021 |
| Yuanpei Outstanding Young Scholars                               | Dec 2020  |
| Lin-bridge First Prize for Undergraduate Research                | Sep. 2020 |
| Yuanpei College First Award for Undergraduate Research           | Jun. 2020 |
| Xingcheng Award for Undergraduate Research                       | May 2019  |
| National Undergraduate Research & Training Program               | May 2019  |
| Peking University Scholarship for Outstanding Freshmen           | Sep. 2016 |

## TEACHING AND MENTORING

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|   |             |
|---|-------------|
| Co-advising Princeton Undergraduate: Milo Salvucci  | 2025        |
| Teaching Assistant for Cosmology  | Spring 2024 |
| Teaching Assistant for General Relativity   | Fall 2023   |
| Co-advising Princeton Undergraduate: Sajia Shahrin Neha   | 2023        |
| Lecture on Flatiron Institute CCA Fluid Dynamics Summer School<br><i>GPU Computing using AthenaK: Black Hole Accretion and Supernova Remnants</i> | Aug. 2023   |

## SERVICE AND OUTREACH

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| Reviewer for the Astrophysical Journal (ApJ)   | 2024 – Now      |
| <a href="#">Prison Teaching Initiative</a>   | Jan. 2025 - Now |
| Teaching Astronomy   |                 |
| Member of the Learning the Universe Collaboration  | Sep. 2022 – Now |
| <a href="#">Astronomy on Tap Trenton: How does a tiny black hole affect the entire galaxy?</a> | Mar. 2025       |
| Member of the Local Organizing Committee, Learning the Universe Collaboration meeting          | Mar. 2025       |
| Member of the Mental Health Working Group  | 2023 – 2024     |
| Co-organizer of the Princeton Astrophysics Thunch, Astronomy                                   | 2022 – 2023     |

## TECHNICAL SKILLS

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| <b>Programming:</b> Proficient in Python, C/C++, L <sup>A</sup> T <sub>E</sub> X, Mathematica, Git; Basic knowledge of Matlab, Fortran, and HTML/CSS. |
| <b>Software and Packages:</b> AthenaK, Athena++, MPI, OMP, cuda, SymPy, yt, emcee, VisIt, ParaView, PLUTO, IRAF, GALFIT                               |
| <b>Techniques:</b> Numerical simulations, massive parallel computing on supercomputer, dataset analyzing and visualization.                           |

## SOFTWARE DEVELOPMENT

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- [AthenaK](#) (Developer): Block-based AMR framework with fluid, particle and numerical relativity solvers in Kokkos.
- [AthenaKit](#) (Owner): Toolkit for analysis and visualization of simulations by AthenaK
- [pySTGROMX](#) (Owner): Extended reduced-order surrogate models for scalar-tensor gravity of Damour and Esposito-Farèse (DEF)

## PRESENTATIONS AND CONFERENCES

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| Caltech TAPIR Seminar<br>(Oral talk) <i>Accretion and Feedback from Galaxies to Event Horizons</i>   | Pasadena, CA<br>Oct. 2025              |
| UC Santa Barbara Astro Lunch<br>(Oral talk) <i>Accretion and Feedback from Galaxies to Event Horizons</i>  | Santa Barbara, CA<br>Oct. 2025         |
| KIPAC Compact Objects Group meeting<br>(Oral talk) <i>Multiscale structure of black hole accretion flows</i>   | Stanford, CA<br>Oct. 2025              |
| KIPAC Tea Talk<br>(Oral talk) <i>Accretion and Feedback from Galaxies to Event Horizons</i>  | Stanford, CA<br>Oct. 2025              |
| Theoretical Astrophysics Center Seminar<br>(Oral talk) <i>Accretion and Feedback from Galaxies to Event Horizons</i>   | Berkeley, CA<br>Oct. 2025              |
| Flatiron Institute CCA Numerical Series<br>(Invited talk) <i>Cyclic Zoom: Multiscale GRMHD modeling of Black Hole Accretion and Feedback</i>                     | New York<br>Jun. 2025                  |
| Northwestern CIERA Theory Group Meeting<br>(Oral talk) <i>Accretion and Feedback from Galactic to Horizon Scales</i>   | Evanston, Illinois<br>Jun. 2025        |
| Flatiron Institute CCA Coffee Talk<br>(Oral talk) <i>Accretion and Feedback from Galactic to Horizon Scales</i>  | New York<br>May 2025                   |
| Caltech TAPIR Astronomy Talk<br>(Oral talk) <i>Evolution of Supernova Remnants in a Cloudy Multiphase Interstellar Medium</i>                                    | Pasadena, CA<br>May 2025               |
| The Institute for Theory and Computation (ITC) luncheons<br>(Oral talk) <i>Magnetized Accretion onto and Feedback from Supermassive Black Holes</i>              | Boston, MA<br>Apr. 2025                |
| UMich extreme-astroph seminar<br>(Oral talk) <i>Multi-scale GRMHD Modeling of Black Hole Accretion and Feedback over Galactic Scales</i>                         | Ann Arbor, Michigan<br>Apr. 2025       |
| The 245th Meeting of the American Astronomical Society<br>(Oral talk) <i>Magnetized Accretion onto and Feedback from Supermassive Black Holes</i>                | National Harbor, Maryland<br>Jan. 2025 |
| DCC Workshop: Deciphering the Cosmic Code for Galaxy Formation<br>(Oral talk) <i>Magnetized Accretion onto and Feedback from Supermassive Black Holes</i>        | Puerto Varas, Chile<br>Dec. 2024       |
| Harvard BHI Workshop: Bridging Scales in the Black Hole Accretion-Feedback Problem<br>(Invited talk) <i>Multi-Scale Simulations of Galaxy-SMBH Feeding</i>       | Boston, MA<br>May 2024                 |
| UC Santa Barbara Astro Lunch<br>(Oral talk) <i>Evolution of Supernova Remnants in a Cloudy Multiphase Interstellar Medium</i>                                    | Santa Barbara, CA<br>Jan. 2024         |
| KITP Program: Turbulence in Astrophysical Environments<br>(Oral talk) <i>Toward Horizon-scale Accretion onto Supermassive Black Holes in Elliptical Galaxies</i> | Santa Barbara, CA<br>Jan. 2024         |

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| Black Holes on Broadway: The Next Generation of AGN Models in Galaxy Formation<br>(Oral talk) <i>Toward Horizon-scale Accretion onto Supermassive Black Holes in Elliptical Galaxies</i> | New York<br>Dec. 2023          |
| PKU KIAA Seminar<br>(Oral talk) <i>Toward Horizon-scale Accretion onto Supermassive Black Holes in Elliptical Galaxies</i>   | Beijing, China<br>Oct. 2023    |
| Galaxy Formation in Hangzhou: Observations and Physics of AGN Feedback<br>(Oral talk) <i>Toward Horizon-scale Accretion onto Supermassive Black Holes in Elliptical Galaxies</i>         | Hangzhou, China<br>Oct. 2023   |
| The Second Athena++ Workshop<br>(Oral talk) <i>Toward Horizon-scale Accretion onto Supermassive Black Holes in Elliptical Galaxies</i>   | New York<br>May 2023           |
| Learning the Universe Annual Meeting<br>(Oral talk) <i>Accretion of Supermassive Black Holes in Elliptical Galaxies</i>  | New York<br>Sep. 2022          |
| The 240th Meeting of the American Astronomical Society<br>(Poster presentation) <i>Accretion of Supermassive Black Holes in Elliptical Galaxies</i>                                      | Pasadena, CA<br>Jun. 2022      |
| 2020 PKU-DoA Undergraduate Astronomy Symposium<br>(Oral talk) <i>Hunting for Wandering Massive Black Holes</i>   | Beijing, China<br>Sep. 2020    |
| 2019 PKU-DoA Undergraduate Astronomy Symposium<br>(Oral talk) <i>A New Channel of Bulge Formation via the Destruction of Short Bars</i>  | Beijing, China<br>Sep. 2019    |
| 2019 Annual Meeting of Chinese Astronomical Society<br>(Oral talk) <i>A New Channel of Bulge Formation via the Destruction of Short Bars</i>   | Delingha, China<br>Sep. 2019   |
| São Paulo School of Advanced Science on First Light  | São Paulo, Brazil<br>Aug. 2019 |
| IAU Symposium 353: Galactic Dynamics in the Era of Large Surveys<br>(Poster) <i>The Role of Short Bar Destruction in Regulating the Co-evolution of Black Holes and Bulges</i>           | Shanghai, China<br>Jun. 2019   |