Jing-Ze Ma (马竟泽) | Curriculum Vitae

Astrophysicist | jingze@mpa-garching.mpg.de | jingzema.com

Research interests

Theoretical & computational astrophysics: Radiation magnetohydrodynamics, Massive stars, Binary stars, Supernovae and other transients, Gravitational wave progenitors

Education

PhD candidate in Astrophysics — Sep. 2022 – 2026 (expected)
Max Planck Institute for Astrophysics | Ludwig-Maximilians-Universität München — *Garching | Munich, Germany*
- Advisor: Prof. Selma de Mink. Close collaborators: Ruediger Pakmor, Stephen Justham, Andrea Chiavassa
- Topic: *Multi-scale convection and mass ejections in 3D red supergiant stars*

Bachelor of Engineering in Engineering Mechanics — Aug. 2018 – June 2022
Tsinghua University — *Beijing, China*
- Thesis: *Diverse stellar models with random transverse magnetic fields* (Outstanding bachelor's thesis in Tsinghua)

Other research experience

Undergraduate internship — Oct. 2021 – Apr. 2022
Max Planck Institute for Astrophysics (remote due to COVID) Advisor: Dr. Rob Farmer — *Garching, Germany*
- Ma, Farmer, de Mink, Laplace, accepted in A&A, 2025

Undergraduate summer internship — June 2021 – Oct. 2021
University of Neveda, Las Vegas (remote due to COVID) Advisor: Prof. Bing Zhang — *Nevada, USA*
- Ma & Zhang, MNRAS, 2022a; Ma & Zhang, MNRAS, 2022b

Selected honors and awards

Kippenhahn Prize (Once per year for the best paper by a MPA student) — 2024
Max Planck Institute for Astrophysics — *Garching, Germany*

Outstanding bachelor's thesis — 2022
Tsinghua University — *Beijing, China*

Publications

** indicates papers of my students. See also **ADS** or **Google scholar**

In preparation:

1. **Giovanni Stimamiglio, **Jing-Ze Ma**, Ylva Götberg, and Selma E. de Mink. "Theoretical predictions on the surface magnetic fields of binary-stripped massive stars". *in preparation*, 2025.
2. **Jing-Ze Ma**, Selma E. de Mink, Stephen Justham, Andrea Chiavassa, Rüdiger Pakmor, and Taeho Ryu. "Reversed supergranulation in supergiant stars due to cooling-driven rainy convection". *to be submitted to Nature Astronomy*, 2025.

Published & submitted:

3. **Jing-Ze Ma**, Stephen Justham, Ruediger Pakmor, Andrea Chiavassa, Taeho Ryu, and Selma E. de Mink. "AREPO-RSG: Aspherical Circumstellar Material and Winds from Pulsating Dusty Red Supergiants in Global 3D Radiation Hydrodynamic Simulations". *submitted to ApJL*, 2025.
4. **Jing-Ze Ma**, Rob Farmer, Selma E. de Mink, and Eva Laplace. "Carbon from massive binary-stripped stars: effect of metallicity". *accepted in A&A*, 2025.
5. **Jing-Ze Ma**, Rüdiger Pakmor, Stephen Justham, and Selma E. de Mink. "AREPO-IDORT: Implicit Discrete Ordinates Radiation Transport for Radiation Magnetohydrodynamics on an Unstructured Moving Mesh". *submitted to A&A*, 2025.
6. **Jing-Ze Ma**, Andrea Chiavassa, Selma E. de Mink, Ruggero Valli, Stephen Justham, and Bernd Freytag. "Is Betelgeuse Really Rotating? Synthetic ALMA Observations of Large-scale Convection in 3D Simulations of Red Supergiants". *ApJL*, 962:L36, 2024.
7. Yu-Qing Lou and **Jing-Ze Ma**. "Supermassive stars with random transverse magnetic fields". *MNRAS*, 516:1481, 2022.
8. **Jing-Ze Ma** and Bing Zhang. "Reverse shock forming condition for magnetized relativistic outflows: reconciling theories and simulations". *MNRAS*, 514:3725, 2022.

9. **Jing-Ze Ma** and Bing Zhang. "Relativistic oblique shocks with ordered or random magnetic fields: tangential field governs". *MNRAS*, 511:925, 2022.
10. **Jing-Ze Ma**, Hong-Yu Lu, Xiao-Song Li, and Yu Tian. "Interfacial phenomena of water striders on water surfaces: a review from biology to biomechanics". *Zoological Research*, 41(3):231, 2020.

Minor contributions:

11. Taeho Ryu, Re'em Sari, Selma E. de Mink, Orr David, Ruggero Valli, **Jing-Ze Ma**, Stephen Justham, Ruediger Pakmor, and Hans Ritter. "Binary mass transfer in 3D: Mass transfer rate and morphology". *A&A*, 702:A61, 2025.
12. Chen Wang, Lee Patrick, Abel Schootemeijer, Selma E. de Mink, Norbert Langer, Nikolay Britavskiy, Xiao-Tian Xu, Julia Bodensteiner, Eva Laplace, Ruggero Valli, Alejandro Vigna-Gómez, Jakub Klencki, Stephen Justham, Cole Johnston, and **Jing-Ze Ma**. "Using Detailed Single-star and Binary-evolution Models to Probe the Large Observed Luminosity Spread of Red Supergiants in Young Open Star Clusters". *ApJL*, 981:L16, 2025.
13. Ruggero Valli, Christopher Tiede, Alejandro Vigna-Gómez, Jorge Cuadra, Magdalena Siwek, **Jing-Ze Ma**, Daniel J. D'Orazio, Jonathan Zrake, and Selma E. de Mink. "Long-term evolution of binary orbits induced by circumbinary disks". *A&A*, 688:A128, 2024.
14. Rob Farmer, Eva Laplace, **Jing-Ze Ma**, Selma E. de Mink, and Stephen Justham. "Nucleosynthesis of Binary-stripped Stars". *ApJ*, 948:111, 2023.
15. Taeho Ryu, Rosalba Perna, Ruediger Pakmor, **Jing-Ze Ma**, Rob Farmer, and Selma E. de Mink. "Close encounters of tight binary stars with stellar-mass black holes". *MNRAS*, 519:5787, 2023.

Talks and conferences

- **Invited review:**

Paris Observatory, France, **Workshop: Horizons for Optical Long Baseline Interferometry**, 2025/01
Massive Binary Science in the 2040s **SLIDES**

- **Invited:**

UC Berkeley, California, USA, **Astronomy department lunch talk**, 2025/11
Carnegie Observatories, Pasadena, USA, **Anthony Piro's group meeting**, 2025/11
Caltech, Pasadena, USA, **Astronomy Tea Talk**, 2025/11
University of Colorado Boulder, USA, **Astrophysical & Planetary Sciences Lunch Seminar**, 2025/11
Princeton Unviersity, USA, **Eliot Quataert's group meeting**, 2025/11
Institute for Advanced Study, Princeton, USA, **Astro Coffee**, 2025/11
Flatiron Institute (CCA), New York, USA, **Stars & Plasma Astrophysics group meeting**, 2025/11
MPIA (MPI for Astronomy, Heidelberg), Germany, **Galaxy Coffee**, 2025/07
MPIA (MPI for Astronomy, Heidelberg), Germany, **Mario Flock's group meeting**, 2025/07
ESO (European Southern Observatory), Germany, Stellar Coffee and Planetary Tea, 2024/11
HITS (Heidelberg Institute for Theoretical Studies), Germany, **Fritz Röpke's group meeting**, 2024/11
Université Côte d'Azur, Nice, France, **PEPPER collaboration meeting**, 2024/10
Argelander Institute for Astronomy, Bonn, Germany, **Norbert Langer's group meeting**, 2024/04
MPI for Gravitational Physics (AEI), Potsdam, Germany, **CRA seminar**, 2024/03
Université Côte d'Azur, Nice, France, **Stellar & solar physics seminar**, Lagrange Laboratory, 2023/03
Tsinghua University, Beijing, China, **Planet-Disk-Star seminar**, 2022/05

- **Contributed:**

Tsinghua University, Beijing, China, **Planet-Disk-Star seminar**, 2024/09
Dali, China, **Conference: The Progenitors of Supernovae and their Explosions**, 2024/08
Lorentz Center, Leiden, Netherlands, **Workshop: Stripped stars**, 2024/07
KITP, Santa Barbara, USA, **Workshop: Tidal disruption events**, 2024/05 **VIDEO**
Carnegie Observatories, Pasadena, USA, **Andrew Benson's group meeting**, 2024/05
Caltech, Pasadena, USA, **Astronomy Tea Talk**, 2024/05
Flatiron Institute (CCA), New York, USA, **Gravitational Wave group meeting / Stars & Plasma Astrophysics group meeting**, 2024/04
Harvard University, Boston, USA, **Lars Hernquist's group meeting**, 2024/04
MIT, Boston, USA, **Mark Vogelsberger's group meeting**, 2024/04

MIT Haystack Observatory, USA, **Radio Stars in the Era of New Observatories**, 2024/04 **SLIDES**
Leiden University, Netherlands, **Elena M. Rossi's group meeting**, 2023/12
Zoom, **PEPPER collaboration meeting**, 2023/12
MIAPbP, Garching, Germany, **Workshop: Gaia, spectroscopy & asteroseismology**, 2023/08
Krakow, Poland, **European Astronomical Society (EAS) Annual Meeting**, 2023/07
MPA, Garching, Germany, **VLT-FLAMES Tarantula Survey Collaboration Meeting**, 2023/03
MIAPbP, Garching, Germany, **Workshop: Impact of Binaries on Stellar Evolution**, 2022/11
Zoom, **SuperVirtual**, 2022/11 **VIDEO (39:00-56:00)**

Professional activities

Referee: The Astrophysical Journal (ApJ; 2023-)
Organizers: MPA stellar seminar (2024-2025); Half-day 20-people workshop on stellar B field

Programming Skills

Astrophysical codes:
Developer:
AREPO (3D moving-mesh radiation MHD): Core developer of the state-of-the-art radiation module.
Seven-League Hydro (3D implicit MHD): Experimental extensions for exoplanetary atmosphere.
COMA (3D radiative transfer): My Python code to produce mock ALMA spectra from 3D simulations.
Advanced user (personal modifications to the codes):
MESA (1D stellar evolution): Modified for simplified B field evolution and impacts on stellar structure.
MAGRETTE (3D radiative transfer): Incorporated continuum opacity.
User (basic level): **CO5BOLD** (3D radiation MHD; Analyzing output), **FASTCHEM** (chemstry)
Languages: Fortran, C/C++, Python, Bash, Matlab
Visualization: PyVista, Plotly, yt, Paraview, Matplotlib, TULIPS

Successful proposals

2024-2025, Scientific PI, NHR@FAU (tier 2), **10 million CPU hours** on Fritz supercomputer
A grid of global 3D moving-mesh radiation hydrodynamic simulations of red supergiant envelopes

Mentoring

Master student: 2024/03-present, Giovanni Stimamiglio, LMU (University of Munich), continued as PhD at MPA
Primary advisor, weekly meeting, co-advised with formal advisor de Mink (Stimamiglio, Ma, et al. in prep.)
PhD student: 2025/07-present, Silvia Anastasia Popa, MPA – Help with MESA setup

Media coverage and outreach

Media coverage:
2024/03, ApJL paper featured in Scientific American, Nature Astronomy, AAS Nova, INAF (Italian)
Public talks:
2025/07, Two invited talks at X-Institute summer school for first-year bachelor students, Shenzhen, China
Light-years away: How to make weather forecasts for stars and giant exoplanets
2024/04, One-hour podcast in Mandarin (Romantic research) with X-Institute mentors, Shenzhen, China
2024/01&07, Three invited talks at winter/summer school for high school students, Shenzhen, China
How to see through the disguise of a star
2022/01, Invited talk at X-Institute winter school for college students across all disciplines, Shenzhen, China
An engineering student's pathway to astronomy

References

Prof. Selma de Mink, Scientific director, Max Planck Institute for Astrophysics (MPA) – Formal advisor
Prof. Jim Fuller, Professor, Caltech – Interactions during multiple visits
Prof. Volker Springel, Scientific director, MPA – Interactions during multiple discussions
Dr. Rüdiger Pakmor, Permanent scientific staff, MPA – Advisor on technical aspects
Dr. Andrea Chiavassa, Permanent researcher, CNRS, Observatoire de la Cote d'Azur – Close collaborator
Dr. Stephen Justham, Permanent scientific staff, MPA – Close collaborator