Jing-Ze Ma (马竟泽) | Curriculum Vitae

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

Research interests

Theoretical astrophysics: Radiation (magneto-)hydrodynamics, Massive stars, Binary stars, Supernovae and other transients, Gravitational wave progenitors

Education

Sep. 2022 – 2026 (expected) **PhD candidate in Astrophysics**

Garching | Munich, Germany *Max Planck Institute for Astrophysics | Ludwig-Maximilians-Universität München*

- Supervisor: Prof. Selma de Mink
- Tentative topic: *Massive binary stars: bridging 1D and 3D*

Aug. 2018 – June 2022 **Bachelor of Engineering in Engineering Mechanics**

Beijing, China *Tsinghua University*

- GPA: 3.80/4.00
- Thesis: *Diverse stellar models with random transverse magnetic fields* (Outstanding bachelor's thesis in Tsinghua)

Publications (4+2 First-author, Citations 44, h-index 3)

See also **ADS** or **Google scholar**

10. **Jing-Ze Ma**, Rob Farmer, and Selma E. de Mink. "Carbon yield from massive binary-stripped stars: effect of metallicity and orbital period". *in preparation*, 2024.
9. **Jing-Ze Ma**, Ruediger Pakmor, and et al. "AREPO-IRT family: Radiation hydrodynamics on a moving mesh based on implicit radiation transport - flux-limited diffusion, M1 closure, variable eddington tensor, and discrete ordinates". *in preparation*, 2024.
8. **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". *The Astrophysical Journal Letters*, 962:L36, 2024.
7. Yu-Qing Lou and **Jing-Ze Ma**. "Supermassive stars with random transverse magnetic fields". *Monthly Notices of the Royal Astronomical Society*, 516:1481, 2022.
6. **Jing-Ze Ma** and Bing Zhang. "Reverse shock forming condition for magnetized relativistic outflows: reconciling theories and simulations". *Monthly Notices of the Royal Astronomical Society*, 514:3725, 2022.
5. **Jing-Ze Ma** and Bing Zhang. "Relativistic oblique shocks with ordered or random magnetic fields: tangential field governs". *Monthly Notices of the Royal Astronomical Society*, 511:925, 2022.
4. **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:

3. 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". *submitted to Astronomy & Astrophysics*, 2024.
2. R. Farmer, E. Laplace, **Jing-Ze Ma**, S. E. de Mink, and S. Justham. "Nucleosynthesis of Binary-stripped Stars". *The Astrophysical Journal*, 948:111, 2023.
1. 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". *Monthly Notices of the Royal Astronomical Society*, 519:5787, 2023.

Professional activities

Referee: The Astrophysical Journal (ApJ; 2023-)

Programming Skills

Astrophysical codes:
- Developer:
  - **COMA** (3D radiative transfer): Python package to produce mock ALMA spectra from 3D simulations.
- Advanced user (personal modifications to the codes):
  - **AREPO** (3D radiation MHD): Leading developer of the state-of-the-art radiation module (ongoing).
  - **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 hydro; Analyzing output), **FASTCHEM2** (chemstry)

Languages: Fortran, C/C++, Python, Bash, Matlab

Visualization: Paraview, PyVista, Plotly, yt, Matplotlib, TULIPS

Talks and conferences

- **Invited:**

Argelander Institute for Astronomy, Bonn, Germany, **Norbert Langer's group meeting**, 2024/04
Bright future of 3D stars: Bridging theories & observations

MPI for Gravitational Physics (AEI), Potsdam, Germany, **CRA seminar**, 2024/03
Massive star radiation hydrodynamics: Bridging theories & observations

Université Côte d'Azur, Nice, France, **Stellar & solar physics seminar**, Lagrange Laboratory, 2023/03
Are massive stars more efficient carbon factories when stripped in binaries?
A brief demonstration of MESA

Tsinghua University, Beijing, China, **Planet-Disk-Star seminar**, Institute for Advanced Study, 2022/05
Are binary-stripped massive stars more efficient carbon factories: effect of metallicity and orbital period

- **Contributed:**

MIT Haystack Observatory, Boston, USA, **Radio Stars in the Era of New Observatories**, 2024/04
Synthetic ALMA observations of large-scale convection in 3D simulations of Red Supergiants

MIAPbP, Garching, Germany, **Workshop: Gaia, spectroscopy & asteroseismology**, 2023/08
3D simulations of red supergiants: rotator imposter and beyond

Krakow, Poland, **European Astronomical Society (EAS) Annual Meeting**, 2023/07
Is Betelgeuse really rotating?

MPA, Garching, Germany, **VLT-FLAMES Tarantula Survey Collaboration Meeting**, 2023/03
Are there rotating red supergiants? Insights from 3D simulations

MIAPbP, Garching, Germany, **Workshop: Impact of Binaries on Stellar Evolution**, 2022/11
Are massive supernova progenitors more efficient element factories when stripped in binaries?

Zoom, **SuperVirtrul**, 2022/11
Are massive supernova progenitors more efficient element factories when stripped in binaries? (39:00-56:00)

- **Other talks:**

Caltech, Pasadena, USA, **Astronomy Tea Talk**, 2024/05
TBD

Harvard University, Boston, USA, **Lars Hernquist's group meeting**, 2024/04
Towards the AREPO-Star project: Moving-mesh radiation hydrodynamics of stellar interactions & beyond

MIT, Boston, USA, **Mark Vogelsberger's group meeting**, 2024/04
AREPO-IRT: Implicit moving-mesh radiation hydrodynamics

Leiden University, Netherlands, **Elena M. Rossi's group meeting**, 2023/12
Massive star radiation hydrodynamics: Bridging theories & observations

Zoom, **PEPPER collaboration meeting**, 2023/12
Is Betelgeuse really rotating?

MPA, Garching, Germany, **Arepo Week of Code Workshop**, 2023/11
Towards AREPO-IDORT: Implicit discrete-ordinate radiation & explicit hydrodynamics on a moving mesh

MPA, Garching, Germany, **MPA-Kavli summer program**, 2023/08
Light up 3D stars - Exploring accurate radiative transfer in AREPO / CO5BOLD / your favorite code

MPA, Garching, Germany, **MPA stellar seminar**, 2022/02
Are binary-stripped massive stars more efficient carbon factories: effect of metallicity and orbital period

- **Others attended:**

KITP, Santa Barbara, USA, **Workshop: Tidal disruption events**, 2024/04-05

MIAPbP, Garching, Germany, **Workshop: Stellar magnetic fields**, 2023/10

MIAPbP, Garching, Germany, **Workshop: Interacting Supernovae**, 2023/02

Mentoring

2024/03, Giovanni Stimamiglio, Master student at LMU Munich
Three-week project on low-metallicity binary star modelling with MESA

Outreach

2024/04, One-hour podcast with X-Institute mentors, Shenzhen, China
Romantic research

2024/01, Two invited talks at X-Institute winter school for college and 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

Scholarships and honors

2022 (Top **5/140**) **Outstanding bachelor's thesis**
Beijing, China *Tsinghua University*

2021 (Rank **1/380**), 2020 (Rank **4/380**) **Scholarship for Outstanding Scientific Research**
Beijing, China *Tsinghua University*

2020 (Top **50/3800**) **Elected member, 14th *Spark* research scholar cultivation program**
Beijing, China *Tsinghua University*