

Jing-Ze Ma (马竞泽) | Curriculum Vitae

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RESEARCH INTERESTS

Theoretical astrophysics: Radiation (magneto-)hydrodynamics, 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

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

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

Tsinghua University Beijing, China

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

PUBLICATIONS

See also [ADS](#) or [Google scholar](#)

10. **Jing-Ze Ma**, Ruediger Pakmor, and et al. “AREPO-IDORT: Implicit Discrete Ordinates Radiation Transport for Radiation Hydrodynamics on a Moving Mesh”. *in preparation*, 2024.
9. **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.
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”. *Astronomy and Astrophysics*, 688:A128, 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:

AREPO (3D radiation MHD): Core developer of the state-of-the-art radiation module.

COMA (3D radiative transfer): Python package 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 hydro; Analyzing output), **FASTCHEM2** (chemistry)

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**, 2022/05

Are binary-stripped massive stars more efficient carbon factories: effect of metallicity and orbital period

• Contributed:

Dali, China, **The Progenitors of Supernovae and their Explosions**, 2024/08

Bright future of 3D red supergiants as supernova progenitors

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 **SLIDES**

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 **VIDEO (39:00-56:00)**

Are massive supernova progenitors more efficient element factories when stripped in binaries?

• Other talks:

Tsinghua University, Beijing, China, **Planet-Disk-Star seminar**, 2024/09

Towards the AREPO-Star project: Moving-mesh radiation hydrodynamics of (interacting) stars & beyond

MPA, Garching, Germany, **MPA stellar seminar**, 2024/06

Towards the AREPO-Star project: Moving-mesh radiation hydrodynamics of (interacting) stars & beyond

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

Towards the AREPO-Star project: Moving-mesh radiation hydrodynamics of (interacting) stars & beyond

Carnegie Observatories, Pasadena, USA, **Andrew Benson's group meeting**, 2024/05

Are massive stars more efficient carbon factories when stripped in binaries?

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

Towards the AREPO-Star project: Moving-mesh radiation hydrodynamics of (interacting) stars & beyond

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:**

MIAPbP, Garching, Germany, [Workshop: Stellar magnetic fields](#), 2023/10

MIAPbP, Garching, Germany, [Workshop: Interacting Supernovae](#), 2023/02

SUCCESSFUL PROPOSALS

2024-2025, Project manager, NHR@FAU (tier 2), **10 million CPU hours** on [Fritz supercomputer](#)

'First light' of the AREPO-Star project: A grid of global 3D moving-mesh radiation hydrodynamic simulations of red supergiant envelopes (PI: Selma de Mink)

MENTORING

2024/03, Giovanni Stimamiglio, Master student at LMU (University of Munich)

Three-week project on low-metallicity binary star modelling with MESA

OUTREACH

2024/07, Invited talk at X-Institute winter school for high school students, Shenzhen, China

How to see through the disguise of a star

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

SELECTED HONORS AND AWARDS

Kippenhahn Prize (Best annual student publication)

2024

Max Planck Institute for Astrophysics

Garching, Germany

Outstanding bachelor's thesis

2022

Tsinghua University

Beijing, China

Elected member, 14th *Spark* research scholar cultivation program

2020

Tsinghua University

Beijing, China