

Jing-Ze Ma (马竞泽) | Curriculum Vitae

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

RESEARCH INTERESTS

Theoretical & computational astrophysics: Radiation magnetohydrodynamics, Massive stars, Binary stars, Exoplanetary atmosphere, 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](#)

14. **Jing-Ze Ma**, Andrea Chiavassa, Selma E. de Mink, Rüdiger Pakmor, Stephen Justham, and Taeho Ryu. “3D AREPO Red Supergiant Models: Multi-scale Transonic Convection and Inefficient Dredge-up”. *in preparation*, 2025.
13. **Jing-Ze Ma**, Selma E. de Mink, Rüdiger Pakmor, Andrea Chiavassa, Stephen Justham, and Taeho Ryu. “3D AREPO Red Supergiant Models: Pulsation-lifted Aspherical Clumpy Circumstellar Material at Pre-supernova Stages”. *in preparation*, 2025.
12. **Jing-Ze Ma**, Rob Farmer, Selma E. de Mink, and Eva Laplace. “Carbon from massive binary-stripped stars over cosmic time: effect of metallicity”. *submitted to Astronomy and Astrophysics*, 2025.
11. **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 Astronomy and Astrophysics*, 2025.
10. **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.
9. Yu-Qing Lou and **Jing-Ze Ma**. “Supermassive stars with random transverse magnetic fields”. *Monthly Notices of the Royal Astronomical Society*, 516:1481, 2022.
8. **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.
7. **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.
6. **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:

5. Taeho Ryu, Re'em Sari, Selma E. de Mink, Orr David, Ruggero Valli, **Jing-Ze Ma**, Stephen Justham, Rüdiger Pakmor, and Hans Ritter. “Binary mass transfer in 3D - Mass Transfer Rate and Morphology”. *to be submitted*, 2025.
4. 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”. *The Astrophysical Journal Letters*, 981:L16, 2025.

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-)

Organizers: MPA stellar department seminar (2024-2025); Half-day 20-people workshop on stellar B field

PROGRAMMING SKILLS

Astrophysical codes:

Developer:

AREPO (3D 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): 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 MHD; Analyzing output), **FASTCHEM** (chemistry)

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

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

TALKS AND CONFERENCES

• Invited:

Paris Observatory, France, **Horizons for Optical Long Baseline Interferometry workshop**, 2025/01

Invited Review: Massive Binary Science in the 2040s

ESO (European Southern Observatory), Germany, Stellar Coffee and Planetary Tea, 2024/11

‘First light’ of the AREPO-Star project: Global 3D moving-mesh rad hydro simulations of RSG envelopes

HITS (Heidelberg Institute for Theoretical Studies), Germany, **Fritz Röpke’s group meeting**, 2024/11

‘First light’ of the AREPO-Star project: Global 3D moving-mesh rad hydro simulations of RSG envelopes

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:

Université Côte d’Azur, Nice, France, **PEPPER collaboration meeting**, 2024/10

‘First light’ of the AREPO-Star project: Global 3D moving-mesh rad hydro simulations of RSG envelopes

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

• Short talks:

Lorentz Center, Leiden, Netherlands, [Workshop: Stripped stars](#), 2024/07

Stripped stars as natural labs to test internal stellar magnetism

Flatiron Institute (CCA), New York, USA, [Gravitational Wave group meeting / Stars & Plasma](#)

[Astrophysics group meeting](#), 2024/04

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

• 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

As main advisor:

- 2024/03-present, Giovanni Stimamiglio, Master student at LMU(University of Munich), incoming PhD at MPA
Master thesis on surface magnetic field of stripped stars (co-advisors: Selma de Mink, Ylva Götberg)
- Three-week project on low-metallicity binary star modelling with MESA (co-advisor: Selma de Mink)

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
<i>Max Planck Institute for Astrophysics</i>	<i>Garching, Germany</i>
Outstanding bachelor’s thesis	2022
<i>Tsinghua University</i>	<i>Beijing, China</i>
Elected member, 14th <i>Spark</i> research scholar cultivation program	2020
<i>Tsinghua University</i>	<i>Beijing, China</i>