

Ruggero Valli

PhD Student at Max Planck Institute for Astrophysics

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Research Interests

I am a theoretical astrophysicist who likes to work at the interface of observations, modelling and Bayesian inference. I am interested in binary [stellar populations](#), [massive stars](#) and their interactions. I use [MESA](#) and rapid population synthesis codes, and employ Monte Carlo [Bayesian inference](#) methods to [bridge theory and observations](#). My current focus is on [natal kicks](#) of [neutron stars](#) from stripped envelope [supernovae](#).

Education

[10 Oct 2022](#) – [present](#): PhD student at the Max Planck Institute for Astrophysics, supervisor: Selma de Mink.

[Sep 2020](#) – [28 Sep 2022](#): MSc degree in astrophysics at Sapienza University of Rome, with a grade of 110/110 with honors.

[Sep 2017](#) - [27 Sep 2020](#): BSc degree in physics at Sapienza University of Rome, with a grade of 110/110 with honors.

Grants, Awards and Honors

[2022](#): completed Sapienza Excellence Program alongside the MSc.

[2017-2022](#): every year of university, have earned the university taxes Exemption for Meritorious Students.

[2020](#): completed Sapienza Excellence Program alongside the BSc.

[2014-2017](#): competed in the school's team for the Mathematical Olympiad.

[2016](#): honorable mention at the final competition of the Italian Mathematical Olympiad.

[2016](#): coached the team A.C.M.E. in the First Lego League, which won the Inspirational Award at the European Championship in Tenerife.

[2012 -2020](#): was member of AISTAP (Italian Association for Gifted and Talented Students)

Talks

Invited talks

[Sep. 2025](#) Astrophysics Seminar, *MPI for Gravitational Physics, Potsdam*

[Aug. 2025](#) STRAND seminar, *UC San Diego* (online)

[Feb. 2025](#) Stellar coffee & planetary tea, *ESO, Garching*

Contributed talks

- Nov. 2025 Stellar Populations and their Explosions conference, *Ringberg castle*
- Oct. 2025 2nd BLOeM collaboration meeting, *Amsterdam*
- Oct. 2025 Astro-Obs seminar, *Newcastle University* (online)
- Sep. 2025 Spins-UK conference, *Royal Holloway University of London, Egham*
- May 2025 18th Bonn neutron star workshop, *MPI for Radio Astronomy, Bonn*
- Jan. 2025 MPA institute seminar, *MPA, Garching*
- Nov. 2024 18th IMPRS symposium, *ESO, Garching*
- Jul. 2024 EAS conference, *Padova*
- May 2024 Astronomy Tea Talk, *Caltech, Pasadena*
- Apr.-May 2024 Towards a Physical Understanding of Tidal Disruption Events, *KITP program, Santa Barbara*
- Mar. 2024 Workshop on stable mass transfer in binaries, *CCA, New York City*
- Dec. 2023 ESO Informal Discussion, *ESO, Garching*
- Jun.-Aug. 2023 MPA-Kavli summer program, *MPA, Garching*
- Jun. 2023 15th IMPRS symposium, *MPA, Garching*
- Feb. 2023 Nordic Winter School on Gravitational Astrophysics, *Skeikampen, Norway*

Other workshops and conferences

- Nov. 2024 LISA astrophysics working group meeting, *MPA, Garching*
- Sep. 2024 17th annual meeting of the VFTS collaboration, *ESA, Madrid*
- Mar. 2024 1st meeting of the BLOeM collaboration, *Leuven*
- Sep. 2023 Two in a million conference - The interplay between binaries and star clusters, *ESO, Garching*
- Mar. 2023 16th annual meeting of the VFTS collaboration, *MPA, Garching*
- Mar. 2023 Interacting supernovae workshop, *MIAPbP, Garching*
- Jan. 2023 Tidal Evolution Research Review for Astrophysics workshop, *Lorentz center, Leiden*
- Nov. 2022 The fundamental role of stellar multiplicity in stellar dynamics and evolution, *MIAPbP, Garching*
- Aug. 2022 MESA Summer School, *Santa Barbara*

Publications

A complete list of publications can also be found on my [ADS page](#).

First Authored

1. **Valli**, de Mink, et al. (to be subm.) “*The mass distribution of stripped-envelope supernovae progenitors*”
2. **Valli**, et al. (in prep.) “*The tidal circulatization envelope of binary populations*”
3. **Valli**, de Mink, Justham, et al. (2025) “*Evidence of polar and ultralow supernova kicks from the orbits of Be X-ray binaries*” [arXiv:2505.08857](https://arxiv.org/abs/2505.08857) [under review in **Science**]

4. **Valli**, Tiede, Vigna-Gómez, et al. (2024) “*Long-term evolution of binary orbits induced by circumbinary disks*” [A&A, 688, 128](#)
5. **Valli**, Graziani, et al. (2023) “*BinCodex: a common output format for binary population synthesis*” A white paper from the LISA Synthetic UCB Catalogue Group, [arXiv:2505.08857](#)

Co-authored

6. Lechien, de Mink, **Valli**, et al. (2025) “*Binary stars take what they get: Evidence for Efficient Mass Transfer from Stripped Stars with Rapidly Rotating Companions*” [ApJL 990, 51](#)
Contribution: I helped setup the MESA simulations and contributed to writing the introduction.
7. Sana, et al. (77 co-authors, including **Valli**, 2025) “*A high fraction of close massive binary stars at low metallicity*” [Nat. Astron. 10.1038/s41550-025-02610-x](#)
Contribution: provided general feedback and comments on the manuscript.
8. Olejak, Stegmann, de Mink, **Valli**, et al. (2025) “*Supermassive Black Holes Stripping a Subgiant Star Down to Its Helium Core: A New Type of Multimessenger Source for LISA*” [ApJL, 987, 11](#)
Contribution: I helped setup the MESA simulations and contributed to the discussion regarding the circumbinary disk formation.
9. Bodensteiner, et al. (42 co-authors, including **Valli**, 2025) “*Binarity at LOw Metallicity (BLOeM): Multiplicity properties of Oe and Be stars*” [A&A, 698, 38](#)
Contribution: I crossmatched the Be X-ray binary catalogues with Gaia and produced a first version of figure C.1.
10. Ryu, Sari, de Mink, David, **Valli**, et al. (2025) “*Binary mass transfer in 3D -- Mass Transfer Rate and Morphology*” [A&A, 702, A61](#)
Contribution: Postprocessed the simulation output and produced a first version of Fig. 2.
11. Wang et al. (14 co-authors, including **Valli**, 2025) “*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, 16](#)
Contribution: provided general feedback and comments on the manuscript.
12. Wang et al. (11 co-authors, including **Valli**, 2024) “*Stripped Helium Star and Compact Object Binaries in Coeval Populations: Predictions Based on Detailed Binary Evolution Models*” [ApJL, 975, 20](#)
Contribution: provided general feedback and comments on the manuscript.
13. Ma, Chiavassa, de Mink, **Valli**, et al. (2024) “*Is Betelgeuse Really Rotating? Synthetic ALMA Observations of Large-scale Convection in 3D Simulations of Red Supergiants*” [ApJL, 962, 36](#)
Contribution: I computed 1D rotating red supergiant models and produced Fig. 1.
14. Shenar et al. (77 co-authors, including **Valli**, 2024) “*Binarity at LOw Metallicity (BLOeM): A spectroscopic VLT monitoring survey of massive stars in the SMC*” [A&A 690, A289](#)
Contribution: provided general feedback and comments on the manuscript.
15. Ryu, **Valli**, Pakmor et al. (2023) “*Close encounters of black hole-star binaries with stellar-mass black holes*” [MNRAS, 525, 575](#)
Contribution: I computed the MESA models that were imported in the hydro code.

International collaborations

Binarity at LOw Metallicity (BLOeM) collaboration. Member since the foundation in 2024.

LISA consortium. Member of the LISA synthetic UCB catalogue working group since 2023.

Software

BayesPop	Python library for Bayesian population inference with Monte Carlo methods that I developed. I am planning to release it upon the acceptance of Valli et al. 2025 (arXiv:2505.08857).
Spindler	Software library I developed to compute the long term orbital evolution of a binary in a circumbinary disk, available both in python and c .
MESA	Stellar evolution code. I am proficient with the code and knowledgeable about the implementation of the binary module, mass transfer and tidal interactions. I have worked on the development of an improved tidal prescription.
Rapid BPS	I have used several binary population synthesis (BPS) codes, including SEVN, SeBa, MoBSE, BSEEMP and COSMIC. I have lead the effort for the definition of the common standard output BinCodex.

Outreach

I delivered science outreach talks to ~90 Italian high school students visiting the Max Planck Institute for Astrophysics across three sessions (2024–2025). Each session included a 30-minute scientific presentation, followed by Q&A on scientific topics and careers in academia.

I actively contribute to the Physics and Astronomy Stack Exchange communities, with ~100 questions answered to date, fostering accessible science communication and peer-to-peer learning.

References

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