Annachiara Picco

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SUMMARY

I am a physicist specialized in astrophysics, with expertise in stellar evolution, massive stars, binary systems, compact objects, gravitational wave progenitors, and population synthesis. I am active and engaged in every (science) community I join, striving to promote inclusivity and shared learning.

SKILLS

Programming	Python, Julia, Fortran, C++, Bash, LaTeX
Software	MESA, Parsec, Mathematica, Jems
Observing	Mercator Telescope (La Palma), 300 hours
Languages	Italian (native), English (C2 CEFR), Dutch (B2 CEFR)

ACADEMIC BACKGROUND

October 2021 – Current — **Ph.D. in Astronomy & Astrophysics** — KU Leuven, Leuven, BL
Thesis: Stellar progenitors of the gravitational wave chorus with detailed models
Advised by: Prof. Dr. Hugues Sana & Prof. Dr. Pablo Marchant
Expected graduation date: **May 2026**

2018 – 2021 — **MSc in Physics** — University of Padova, Padova, IT
Thesis: **Opacity effects in the evolution of massive stars**
Advised by: Prof. Paola Marigo

2015 – 2018 — **BSc in Physics** — University of Padova, Padova, IT
Thesis: **Dust evolution in protoplanetary disks**
Advised by: Prof. Francesco Marzari

SELECTED PUBLICATIONS

2025 (Subm) — 1st Author — A&A
Helium stars mergers as a route towards intermediate mass stripped stars
We study the impact of stellar mergers in shaping the observed stripped stars population.

2025 (In prep) — 1st Author — A&A
No hard boundaries: mass transfer stability depends on overshooting and metallicity
This paper is the first comprehensive study of mass transfer stability for binary black holes progenitors with MESA.

2025 — 1st Author — A&A
HR6819: a puffed-up stripped star system challenging stable mass transfer theory
We show that the theory of stable mass transfer cannot explain the properties of HR6819 given its combined interferometric and spectroscopic constraints.

2025 (In prep) — 2nd Author — A&A
Investigating asteroseismic post-mass transfer candidates using population synthesis
We show the potential of detecting binary interaction products with period-spacing asteroseismic patterns. Work led by a Master's student supervised by me at KU Leuven.

2024 — 1st Author — A&A
Forming merging double compact objects with stable mass transfer
We show how orbital tightening via stable mass transfer can lead to different compact object binaries and gravitational wave sources.

2022 — 3rd Author — MNRAS
The B-type Binaries Characterisation Programme II. VFTS 291: A stripped star from a recent mass transfer phase
A case study of a puffed-up star stripped in a binary, in which I simulated the possible formation and evolution.

2025 (Subm) — >3rd Author — A&A
The drastic impact of Eddington-limit induced mass ejections on massive star populations
We developed and calibrated a physically motivated prescription for Eddington-limit–driven mass ejections.

2024 — >3rd Author — Nature Astronomy
An X-ray-quiet black hole born with a negligible kick in a massive binary within the Large Magellanic Cloud
We characterised VFTS 243, the first unambiguous X-ray-quiet black hole outside our Galaxy, showing that its massive companion likely formed through a direct collapse with no supernova kick.

2023
>3rd Author

Searching for compact objects in the single-lined spectroscopic binaries of the young Galactic cluster NGC 6231 — A&A
We identified four B-star binaries in NGC 6231 as candidate compact-object systems, including two likely black hole companions, through spectral disentangling and stellar modelling.

SELECTED AWARDS & GRANTS

2022-Current

Fonds Wetenschappelijk Onderzoek (FWO) Ph.D. fellowship fundamental research — KU Leuven
Competitive fellowship awarded by the Flemish funding agency to pursue my research project independently, grant No. 11M8325N.

2025
1,000 EUR

Travel grant from the Astrophysics Centre for Multimessenger studies in Europe — ACME
Selected for funding based on CV and application, research visit: University of Geneva

2025
1,902 EUR

Travel grant for conference abroad — FWO
To participate to the conference *Binary stars in a new era* in Lijiang, China (PRC), grant No. K1A4925N.

2025
3,870 EUR

Tier-1 Starting grant — VSC
Award for computing time in the Flemish Tier-1 supercomputer facility (VSC), 500,000 CPU-hours.

2024
5,083 EUR

Tier-1 Computing grant — VSC
Award for computing time, 656,640 CPU-hours.

2024
1,330 EUR

Travel grant for workshop and research visit abroad — FWO
To participate to the *Mesa Down Under School* at University of Sydney (NSW) and visit Monash University (VIC), grant No. K223124N.

2024
450 EUR

Travel grant for the conference IAU General Assembly 2024 — IAU
Competitive grant to participate to the conference (>1000 participants), based on application and CV.

2024
518 EUR

Travel grant for workshop abroad — FWO
To participate to the workshop *Stable Mass Transfer in Binaries: from onset to remnants* at Flatiron Institute (NY), grant No. K209924N.

2023
3,870 EUR

Tier-1 Starting grant — VSC
Award for computing time, 500,000 CPU-hours.

2023
120 EUR

Tier-2 Computing grant — VSC
Award for computing time in the Flemish Tier-2 supercomputer facility, 3,600 CPU-hours.

2013-2018
400-800 EUR/yr

Ing. P. Fontana Scholarship — Valdagno, IT
Private scholarship granted to meritorious students residing in the Valdagno district, according to their exam grades.

SOFTWARE DEVELOPMENT

2023-Current
Jems

Jems: Julia Evolutionary Modules for Stars — KU Leuven & UGhent
I am developing the radiative opacity module for the new stellar evolution code Jems, Julia language.

2020-2021
PARSEC

PARSEC: PAdova and TRieste Stellar Evolution Code — University of Padova
I developed a new high-temperature opacity calculation and new opacity tables in PARSEC, Fortran language.

SELECTED ACADEMIC PRESENTATIONS

2025
Contributed

IAUS 402: Massive stars across redshifts in the era of JWST and large surveys — Ensenada, MX
Helium star mergers as a route towards intermediate mass stripped stars

2025
Invited

Binary stars in a new era — Lijiang, CN
No hard boundaries: the mass transfer stability depends on overshooting and metallicity

2025
Flash talk

Gravitational-wave Snowballs, Populations, and models — Sexten, IT
Oral contribution in form of flask presentation talk

2024 Invited	**Challenges and future perspectives in gravitational-wave astronomy: O4 and beyond** *Gravitational wave populations: What have we learned?*	Leiden, NL
2024 Contributed	**XXXII IAU General Assembly 2024** *Forming merging double compact objects with stable mass transfer*	Cape Town, ZA
2024 Contributed	**41st Liège International Astrophysical Colloquium: The eventful life of massive star multiples** *Forming merging double compact objects with stable mass transfer*	Liège, BL
2024 Contributed	**Gravitational Wave Physics and Astronomy Workshop 2024** *Forming merging double compact objects with stable mass transfer*	Birmigham, UK
2024 Contributed	**Astronomy Day of the Royal Observatory of Belgium** *Forming merging double compact objects with stable mass transfer*	Bruxelles, BL
2023 Contributed	**3,2,1: Massive Triples, Binaries and Mergers 2023** *Forming merging double compact objects with stable mass transfer*	Leuven, BL
2023 Flash talk	**Gravitational Wave Populations: What's Next?** Oral contribution in form of a flash presentation talk	Milan, IT
2023 Poster	**The Renaissance of Stellar Black-Hole Detections in The Local Group** *Forming merging double compact objects with stable mass transfer*	Leiden, NL
2022 Poster	**Gravitational Wave Physics and Astronomy Workshop 2022** *The stable mass transfer channel for gravitational wave sources*	Melbourne, AU
2022 Contributed	**Belgian-Dutch Gravitational Wave Meeting 2022** *The stable mass transfer channel for gravitational wave sources*	Ghent, BL

ADVISING & MENTORSHIP

2025 Student project	**HR2142: How to form a bloated stripped star binary with extreme mass ratio via stable mass transfer** Daily supervisor of a research project (6 weeks, 3ECTS).	KU Leuven
2024 - 2025 Master thesis	**Mass transfer stability of massive binaries: the role of stellar structure in forming merging double compact objects** Daily supervisor of master thesis (1 year, 30ECTS), master student: Sasha Graulus.	KU Leuven
2024 Student project	**Explaining classical Wolf-Rayets stars as merger products with MESA** Daily supervisor of a research project (8 weeks, 3ECTS), master student: Mathias Mertens, Emma Zoe Casier, Sebastien Kinif.	KU Leuven
2024 Student project	**Challenging the single star evolution scenario of Be-stars with MESA** Daily supervisor of a research project (6 weeks, 3ECTS), master student: Nick van Wouve.	KU Leuven
2023 - 2024 Master thesis	**Investigating asteroseismic post-mass transfer candidates using population synthesis** Daily supervisor of master thesis (1 year, 30ECTS), master student: Iremsu Taşkın.	KU Leuven
2023 Student project	**Interacting stripped stars: can mass transfer outrule a gravitational wave detection from merging double compact objects?** Daily supervisor of a research project (6 weeks, 3ECTS), master student: Eva Kuipers.	KU Leuven
2023 Student project	**The impact of wind mass loss on the progenitor systems of merging double compact objects with MESA** Daily supervisor of a research project (8 weeks, 3ECTS), master student: Frederic Hallein, Louis Mathijs, Likitha Madhav Mohan Rekha.	KU Leuven
2022 Student project	**Analysing the candidate B+BH VFTS 291 with MESA** Daily supervisor of a research project (6 weeks, 3ECTS), master student: Federica Nardini.	KU Leuven

LARGE COLLABORATIONS

2025-Current	**Massive star far-Ultraviolet Spectroscopic TIme domain (MUSTI)**	KU Leuven
2025-Current	**Belgian Astronomical Society**	Belgian National Committee for Astronomy
2024-Current	**BLOeM: The Binarity at LOw Metallicity campaign**	KU Leuven, Amsterdam and Tel Aviv University

2023-Current **UVEX: The Ultraviolet Explorer** Caltech

LEADERSHIP & OUTREACH

2025
Head organizer
Mesa summer school Leuven Leuven, BL
Head organizer and teaching assistant.

2024
Public lecture
Urania Volkssterrenwacht Seminar Antwerp, BL
Lecture of Gravitational Wave Astronomy and binary stellar evolution in a seminar series of specialized topics for amateur astronomers.

2024
Lecture
Zomerschool Sterrenkunde 2024 Leuven, BL
Lecture of Stellar Evolution to last year high school students.

2023
Lecture
Zomerschool Sterrenkunde 2023 Leuven, BL
Lecture of Stellar Evolution to last year high school students.

2023-Current
Representative
Junior academic staff departmental representative KU Leuven
Leading initiatives for mental health promotion and event organization with the divisions of the Physics and Astronomy department.

2023-Current
Mentorship
High school students orientation day KU Leuven
Mentorship day for last year high school students visiting the Institute of Astronomy.

2022-Current
Head organizer
Get To Know Your Peers: Junior academic staff meetings KU Leuven
Leading the organisation of weekly junior staff meetings in the Institute of Astronomy.

2022-2023
Mentorship
Liceo G.G. Trissino orientation day Valdagno, IT
Mentorship day for last year high school students interested in studying Physics at university.

SERVICE

2025-Current
Referee
Referee for The Astrophysical Journal ApJ
I act as referee in the peer review process for ApJ.

2024-Current
TA
Mesa Summer school 2024, 2025, 2026 Sydney (AU), Leuven, University of Wyoming
Lecturer and teaching assistant.

2023
LOC member
3,2,1: Massive Triples, Binaries and Mergers 2023 Leuven, BL
Member of the Local Organizing Committee for the conference.

2022-Current
Organizer
SPAM Research group KU Leuven
Primary organizer for the Massive binaries research group.

2023
Head organizer
Institute of Astronomy Uitje KU Leuven
Primary organizer for the Institute's team building 3-day retreat: design of group activities and practicalities.

TEACHING EXPERIENCE

2021-2022
TA
B-KUL-G0I55A: Binary stars KU Leuven
Head teaching assistant for the MESA exercise sessions, semester class (6ECTS).

2022-Current
TA
B-KUL-G0Y54A: Stellar Structure and Evolution KU Leuven
Head teaching assistant for the MESA exercise sessions, semester class (6ECTS). Co-designed the website for the class.

2021-Current
Project supervisor
B-KUL-G0W48A: Research Projects in Theoretical Astrophysics KU Leuven
Designed, proposed and supervised 8 weeks (3ECTS) projects for second year master students.

2021-Current
Project supervisor
B-KUL-G0M67A: Research Projects KU Leuven
Designed, proposed and supervised 3 weeks (3ECTS) projects for first year master students.