

Reinhold Willcox

Post-doctoral researcher, stellar and binary astrophysicist
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Citizenship: United States

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Research interests

Interacting binary stellar evolution · Mass transfer stability · Black holes · Neutron stars ·
Core-collapse supernovae · Double compact objects · Gravitational waves

Positions

2023–present. Post-doctoral Researcher. KU Leuven, BE.

Sponsors: Hugues Sana & Pablo Marchant.

Education

PhD 2023. Monash Center for Astrophysics, Monash University, Melbourne, AU.

Advisor: Ilya Mandel.

Thesis: Refining Mass Transfer and Supernova Models in Binary Stellar Populations

BSc 2016. Department of Physics, McGill University, Montreal, QC.

Subject: Joint honours mathematics & physics

Actively contributed open-source software

COMPAS

Rapid binary population synthesis, for exploring statistically meaningful populations of interacting binary stars and their associated outcomes and transients. Targeted at the formation of gravitational-wave sources from merging double compact objects.

SideKicks.jl

Bayesian inference package to determine the core-collapse mass loss and natal kick in dormant black hole binaries. Now works with neutron stars and X-ray binaries.

Teaching

2025. High Energy Astrophysics. Course lead: Gravitational-waves unit. KU Leuven.

2023. Binary Stars. Teaching assistant. KU Leuven.

2023, 2018, 2012-13. Mathematics tutor, grades K-12. Mathnasium Center, Beverly, MA.

2019. Introduction to Astrophysics. Teaching assistant. Monash University.

2013. Advanced Calculus for Engineers. Teaching assistant. McGill University.

Mentorship

Below is a list of students I have supervised in an official capacity at KU Leuven.

Master's students: Emma Casier (*current*), Axel Faniel, Louis Mathijs, Gargi Lokegaonkar, Stephanie Streefland, Bodhisatwa Datta.

Undergraduate students: Michiel Gautama, Jasper Noten.

Professional service & activities

Active Referee — AAS Journals, MNRAS, A&A,

2023-present. Member of KU Leuven organizing committee for steering the direction of the Master's in Astronomy & Astrophysics, 2023-present

2023. Solo observer for the Mercator telescope, 17 nights cumulatively. La Palma, ES.

2019-21. Graduate student representative of the School of Physics & Astronomy for the Monash Graduate Association.

Research visits

Fall 2024. Visiting Researcher. HITS, Heidelberg, DE.

Sponsors: Fabian Schneider & Philipp Podsiadlowski.

Summer 2022. Visiting Researcher. Harvard University, Boston, MA.

Sponsor: Morgan MacLeod.

Outreach

2024, 2025. Course lecturer, "Introduction to Black Holes". KU Leuven, Summer of Science, Leuven, BE.

2022. Invited presenter, "The Diversity of Color, Size, and Texture of Planets". Princeton Art Council, NJ.

2022. Invited speaker, "Friendly stars: current frontiers in our understanding of stellar companions". CAS series public lecture, Melbourne, AU.

2019-22. Monash representative & volunteer. OzGrav Outreach program, Swinburne University, Melbourne, AU.

Non-academic professional experience

2016-17. Technical Analyst. Citrix Systems, Inc. Fort Lauderdale, FL.

Completed technical communication and sales engineer training.

Skills

Software (proficient): Python, Git, Bash, Numpy, Vim

Software (intermediate): Julia, C++, HPC, LaTeX

Languages: English (*native*), French (*conversational*)

Publications

1. **RW**, Schneider, F., Laplace, E., et al. "Good things always come in 3s: trimodality in the binary black-hole chirp-mass distribution supports bimodal black-hole formation." Submitted, arXiv:2510.07573.
2. Picco, A., et al. incl. **RW**. "HR6819: a puffed-up stripped star system challenging stable mass transfer theory." Submitted, arXiv:2509.21521.

3. Sana, H., et al. incl. **RW**. “A high fraction of close massive binary stars at low metallicity.” *Nat. Astro.*, Volume 9, p. 1337-1346, September 2025.
4. Fishbach, M., Breivik, K., **RW**., van Son, L. A. C. “Where are Gaia’s small black holes?” Submitted, arXiv:2508.08986.
5. **RW**, Marchant, P., Vigna-Gómez, et al. “Binarity at LOw Metallicity (BLOeM): Bayesian inference of natal kicks from inert black hole binaries.” *A&A*, Volume 700, August 2025.
6. Mandel, I., et al. incl. **RW**. “Rapid stellar and binary population synthesis with COMPAS: methods paper II.” *ApJS*, Volume 280, Issue 1. September 2025.
7. Rauf, L., et al. incl. **RW**. “A trifecta of modelling tools: a Bayesian binary black hole model selection combining population synthesis and galaxy formation models.” *MNRAS*, Volume 534, Issue 4. November 2024.
8. Shenar, T., et al. incl. **RW**. “Binarity at LOw Metallicity (BLOeM): A spectroscopic VLT monitoring survey of massive stars in the SMC.” *A&A*, Volume 690, October 2024.
9. Vigna-Gómez, A., **RW**, Tamborra, I., et al. “Constraints on Neutrino Natal Kicks from Black-Hole Binary VFTS 243.” *PRL*, Volume 132, May 2024.
10. **RW**, MacLeod, M., Mandel, I., Hirai, R. “The Impact of Angular Momentum Loss on the Outcomes of Binary Mass Transfer.” *ApJL*, Volume 958, December 2023.
11. Romero-Shaw, I., et al. incl. **RW**. “Rapid population synthesis of black hole high-mass X-ray binaries: implications for binary stellar evolution.” *MNRAS*, Volume 524, September 2023.
12. Richards, S. M., et al. incl. **RW**. “New constraints on the Bray conservation-of-momentum natal kick model from multiple distinct observations.” *MNRAS*, Volume 522, July 2023.
13. O’Doherty, T. N., et al. incl. **RW**. “An observationally derived kick distribution for neutron stars in binary systems.” *MNRAS*, Volume 521, May 2023.
14. Stevenson, S., **RW**, Vigna-Gómez, A., Broekgaarden, F. “Wide binary pulsars from electron-capture supernovae.” *MNRAS*, Volume 513, July 2022.
15. Riley, J., Team Compas, et al. incl. **RW**. “Rapid Stellar and Binary Population Synthesis with COMPAS.” *ApJS*, Volume 258, February 2022.
16. **RW**, Mandel, I., Thrane, E., et al. “Constraints on Weak Supernova Kicks from Observed Pulsar Velocities.” *ApJL*, Volume 920, October 2021.
17. Vigna-Gómez, et al. incl. **RW**. “Fallback Supernova Assembly of Heavy Binary Neutron Stars and Light Black Hole-Neutron Star Pairs and the Common Stellar Ancestry of GW190425 and GW200115.” *ApJL*, Volume 920, October 2021.

Selected talks

New LVK results support bimodal-mass black hole formation.

2025. Contributed talk, "Stellar Populations and their Explosions: Bridging the Gap", Tegernsee, DE.

2025. Invited seminar, AEI Potsdam, DE.

2025. Invited seminar, KU Leuven, BE.

2025. Contributed talk, IAU Symposium, Ensenada, MX.

New constraints on black hole natal kicks.

2025. Invited seminar, UC San Diego, CA.

2025. Contributed talk, "Binary Stars in a New Era", Lijiang, CN.

2025. Invited seminar, IAC Tenerife, ES.

2025. Invited seminar, HITS, Heidelberg, DE.

Systematic mistreatment of mass transfer stability boundaries.

2024. Contributed talk, "Eventful Lives of Massive Stars", Liege, BE.

2024. Invited seminar, MPA Garching, DE.

Progenitors of stripped-envelope supernovae as constraints on mass transfer stability.

2024. Contributed talk, "Stable Mass Transfer workshop", Flatiron CCA, NY.

2023. Contributed talk, "Belgian Dutch GW meeting", Maastricht, NL.

2022. Invited seminar, Harvard Gravitational Wave group meeting, Cambridge, MA.

Constraints on weak supernova kicks from observed pulsar velocities.

2021. Invited seminar, OzGrav Data/Astro Telecon., Melbourne, AU.

2021. Invited seminar, SeBa group meeting, online.

2020. Contributed talk, "YITP-OzGrav Joint Workshop", online.

2019. Invited seminar, "Stars in Melbourne conference", Melbourne, AU.

References

Available upon request