



Academic History






- 2022-  **DPhil, University of Oxford** Astrophysics
Supervised by Prof. Bence Kocsis, studying black hole interactions in AGN discs by use of hydrodynamic simulations
- 2017-2021  **MSci, University of Cambridge** Natural Sciences - First Class
Astrophysics specialisation, recipient of scholarship and two college prizes

Research Interests




Active Galactic Nuclei; Black Holes; Hydrodynamics; Binaries; Gravitational Waves; Object-Disc Interactions; Computational and Theoretical Astrophysics; High Performance Computing; Astrophysical Data Visualisation

Research Publications


First Author

- 1 **H. Whitehead**, C. Rowan, and B. Kocsis, “Hydrodynamic simulations of black hole evolution in AGN discs II: inclination damping for partially embedded satellites”, *arXiv e-prints*, arXiv:2505.23899, arXiv:2505.23899, May 2025.  DOI: 10.48550/arXiv.2505.23899. arXiv: 2505.23899 [astro-ph.HE].
- 2 **H. Whitehead**, C. Rowan, and B. Kocsis, “3D Adiabatic Simulations of Binary Black Hole Formation in AGN”, *arXiv e-prints*, arXiv:2502.14959, arXiv:2502.14959, Feb. 01 2025.  DOI: 10.48550/arXiv.2502.14959. arXiv: 2502.14959 [astro-ph.HE].
- 3 **H. Whitehead**, C. Rowan, T. Boekholt, and B. Kocsis, “Disc novae: thermodynamics of gas-assisted binary black hole formation in AGN discs”, vol. 533, no. 2, pp. 1766–1781, Sep. 03 2024.  DOI: 10.1093/mnras/stae1866. arXiv: 2312.14431 [astro-ph.HE].
- 4 **H. Whitehead**, C. Rowan, T. Boekholt, and B. Kocsis, “Gas assisted binary black hole formation in AGN discs”, vol. 531, no. 4, pp. 4656–4680, Jul. 05 2024.  DOI: 10.1093/mnras/stae1430. arXiv: 2309.11561 [astro-ph.GA].
- 5 **H. Whitehead** and J. H. Matthews, “Studying the link between radio galaxies and AGN fuelling with relativistic hydrodynamic simulations of flickering jets”, vol. 523, no. 2, pp. 2478–2497, Aug. 06 2023.  DOI: 10.1093/mnras/stad1582. arXiv: 2305.19328 [astro-ph.HE].

Latter Author

- 1 C. Rowan, **H. Whitehead**, G. Fabj, P. Kirkeberg, M. E. Pessah, and B. Kocsis, “Hydrodynamic simulations of black hole evolution in AGN discs I: orbital alignment of highly inclined satellites”, *arXiv e-prints*, arXiv:2505.23739, arXiv:2505.23739, May 2025. arXiv: 2505.23739 [astro-ph.HE].
- 2 C. Rowan, **H. Whitehead**, G. Fabj, *et al.*, “Prompt gravitational-wave mergers aided by gas in Active Galactic Nuclei: The hydrodynamics of binary-single black hole scatterings”, Apr. 2025.  DOI: 10.1093/mnras/staf547. arXiv: 2501.09017 [astro-ph.GA].
- 3 C. Rowan, **H. Whitehead**, and B. Kocsis, “Black Hole Merger Rates in AGN: contribution from gas-captured binaries”, *arXiv e-prints*, arXiv:2412.12086, arXiv:2412.12086, Dec. 2024.  DOI: 10.48550/arXiv.2412.12086. arXiv: 2412.12086 [astro-ph.HE].
- 4 C. Rowan, **H. Whitehead**, T. Boekholt, B. Kocsis, and Z. Haiman, “Black hole binaries in AGN accretion discs - II. Gas effects on black hole satellite scatterings”, vol. 527, no. 4, pp. 10 448–10 468, Feb. 04 2024.  DOI: 10.1093/mnras/stad3641.

Grants & Research Scholarships




July 2024  UKRI OPP503: PI for Project APP35272 awarded 3.65 million CPUh on CSD3 (Cambridge Service for Data Driven Discovery)

Professional Activities






Referee for various astrophysical journals

- Monthly Notices of the Royal Astronomical Society (MNRAS)
- The Astrophysical Journal (ApJ)
- The Astrophysical Journal Letters (ApJ Letters)
- Astronomy and Astrophysics (A&A)

Conference Presentations

- June 2025  *Inclination Damping of BH Satellites in AGN Discs*,
DYNAMIX, Institute of Astronomy, University of Cambridge
- August 2024  *Cyclonic Winds: 3D Outflows from Black Holes Embedded in AGN Discs*,
The Origin of Black Hole Mergers, Niels Bohr Institute
- December 2023  *Disc Novae: Thermodynamics of Gas Assisted Binary Black Hole Formation in AGN Discs*,
RESCEU-NBIA workshop on gravitational-wave sources, University of Tokyo
- July 2023  *Gas Assisted Binary Black Hole Formation in AGN Discs*,
National Astronomy Meeting, Cardiff University

Skills and Experience

- Coding  Python, C, C++, CUDA, with a strong interest to improve further
- Simulation  Current user of Athena++, previous experience with PLUTO, MESA and Arepo
- Clusters  Experienced user of various High Performance Computing clusters, including Oxford's Advanced Research Computing (ARC) service and the Cambridge Center for Data Driven Discovery (CSD3)
- Internships  8-week research internship studying the hydrodynamics of flickering relativistic jets in AGN (2021, Institute of Astronomy, Cambridge)
-  8-week research internship on the evolution of the convective envelopes of massive stars (2019, Institute of Astronomy, Cambridge)

References

Principle referee Prof. Bence Kocsis (bence.kocsis@physics.ox.ac.uk), others available upon request.