Henry Whitehead

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Academic History

2022- **DPhil, University of Oxford** Astrophysics
Supervised by Professor 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 discs", *MNRAS*, vol. 542, no. 2, pp. 1033–1055, Sep. 2025. DOI: 10.1093/mnras/staf1271. 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", *MNRAS*, 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", *MNRAS*, 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", *MNRAS*, vol. 523, no. 2, pp. 2478–2497, Aug. 06 2023. DOI: 10.1093/mnras/stad1582. arXiv: 2305.19328 [astro-ph.HE].

Latter Author

1. K. V. S. Gasealahwe, K. Savard, I. M. Monageng, I. Heywood, R. P. Fender, P. A. Woudt, J. English, J. H. Matthews, **H. Whitehead**, F. J. Cowie, A. K. Hughes, P. Saikia, and S. E. Motta, "A relativistic jet from a neutron star breaking out of its natal supernova remnant", *MNRAS*, Jul. 2025. DOI: 10.1093/mnras/staf1216.
2. 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].
3. C. Rowan, **H. Whitehead**, G. Fabj, P. Saini, B. Kocsis, M. Pessah, and J. Samsing, "Prompt gravitational-wave mergers aided by gas in active galactic nuclei: the hydrodynamics of binary-single black hole scatterings", *MNRAS*, vol. 539, no. 2, pp. 1501–1515, May 2025. DOI: 10.1093/mnras/staf547. arXiv: 2501.09017 [astro-ph.GA].

4. 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].

5. 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", *MNRAS*, 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 "3D Radiative Simulations of Black Hole Binary/Triple Interactions in AGN Discs" 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 (Contributed)

April 2025 — *Hydrodynamic Simulations of Binary Black Hole Formation in the Discs of AGN*, SPIMAX, University of Oxford (Invited)

August 2024 — *Cyclonic Winds: 3D Outflows from Black Holes Embedded in AGN Discs*, The Origin of Black Hole Mergers, Niels Bohr Institute (Contributed)

December 2023 — *Disc Novae: Thermodynamics of Gas Assisted Binary Black Hole Formation in AGN Discs*, RESCEU-NBIA workshop, University of Tokyo (Contributed)

July 2023 — *Gas Assisted Binary Black Hole Formation in AGN Discs*, National Astronomy Meeting, Cardiff University (Contributed)

Skills and Experience

Coding — Proficient in 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)

Teaching — 100+ hours personal tutoring in Maths and Physics, ranging from primary school to university students