Henry Whitehead

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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 Monthly Notices of the Royal Astronomical Society (MNRAS) and The Astrophysical Journal Letters (ApJ Letters)

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 — Regular user of Oxford's High Performance Computing cluster Hydra and the Cambridge Center for Data Driven Discovery's Cascade Lake

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.