JOSEPH EATSON

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RESEARCH EXPERIENCE

Postdoctoral Researcher, University of Sheffield (2022–2025)

- ◇ Investigating the influence of Short-Lived Radioisotopes (SLRs) on star-forming regions, protoplanetary disks and planetesimals through numerical simulations.
- ◇ Planetesimals are simulated to determine the effect of varying levels of SLR enrichment on final planet volatile content, star-forming regions are simulated to determine the likelihood of enrichment levels.
- ◇ Star-forming regions and disks are simulated via N-body simulations, planetesimals are simulated via a grid-based fluid dynamics and geodynamics model.
- ◇ Research into water retention after planetesimal heating, and how this affects water content of exoplanets, as well as formation of the solar system.
- ◇ Current and future work focussed on developing a new open-source multi-fluid geodynamical model as part of an international collaboration with the Forming Worlds Lab, which aims to implement out-gassing, fluid flow, pebble accretion and percolation for a comprehensive planetesimal model.
- ◇ Further research into a less conventional SLR enrichment route, AGB "interlopers" is also being performed.
- ◇ Initial results suggest that the solar system is relatively highly enriched, however, conventional mechanisms for enrichment have difficulty explaining ^{60}Fe enrichment without being extremely proximal to supernovae, hence importance of AGB "interlopers".

PhD Research, University of Leeds (2017–2022)

- ◇ Investigated the formation of dust within Colliding Wind Binary (CWB) systems.
- ◇ Simulating these systems had significant computational and physical challenges, such as the need for extremely large 3-D grids, cooling through dust and plasma emission, and the complexity of simulating highly unstable winds and shocks.
- ◇ Significant modification of the fluid dynamics code Athena++ performed to achieve this, which was run on the Leeds ARC 4 HPC system.
- ◇ Simulations performed using a passive scalar dust model included in very large-scale 3D hydrodynamical simulations of CWBs to hundreds of AU.
- ◇ Results suggested that dust production within the post-shock region of the wind collision region could result in significant quantities of dust being produced, with favourable density and temperature conditions after cooling.

RELEVANT RESEARCH SKILLS

- ◇ Research background in star formation, planet formation, early-type stellar winds, planetesimals and star forming regions.
- ◇ Comprehensive knowledge of multiple programming languages, in particular 8 years of experience in C, C++, Python, and R – and 4 years of experience using Rust, Fortran and Julia.
- ◇ 8 years programming experience with high-performance compute systems, experience in writing efficient, highly parallel code, experience in utilising HPC clusters and GPU acceleration.
- ◇ Familiarity in using and writing extensions for scientific computing projects such as AMUSE and Athena++.
- ◇ Experience running and analysing the results of fluid dynamics models.

- Experience with writing well-documented code and using version control software such as Git for open-source projects.
- Highly self-motivated researcher, have written multiple papers as first author, handling the majority of the research, writing and feedback from peer review.
- 4 years experience teaching hands-on lab experiments and computing workshops to undergraduate students, as well as assessing and grading practical work.

EDUCATION

University of Leeds (2017–2022)

- Astrophysics PhD – *Numerical Simulations of Dusty Colliding Wind Binaries*
- Date of award – 21st of November 2022

University of Leeds (2013–2017)

- Master of Physics – with merit
- Bachelor of Science – 2.1
- Date of award – 30th of June 2017

Enfield Grammar School (2006-2013)

- A-levels in Mathematics (A), Physics (B) & History (A)
- 13 GCSEs

REFERENCES

Dr. Richard Parker *School of Mathematical & Physical Sciences, University of Sheffield*
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Prof. Julian Pittard *School of Physics & Astronomy, University of Leeds*
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PUBLICATIONS

Papers

- Eatson, Parker & Lichtenberg, 2024, ApJ – *Towards a unified injection model of short-lived radioisotopes in N-body simulations of star-forming regions*
- Eatson, Lichtenberg, Parker & Gerya, 2024, MNRAS – *Devolatilization of extrasolar planetesimals by ^{60}Fe and ^{26}Al heating*
- Eatson, Pittard & Van Loo, 2022, MNRAS – *Exploring dust growth in the episodic WCd system WR140*
- Eatson, Pittard & Van Loo, 2022, MNRAS – *An exploration of dust grain growth within WCd systems using an advected scalar dust model*

Conferences

- Talk: *Heating of planetesimals from ^{60}Fe & ^{26}Al and the effect on the water content of protoplanets* – External Irradiated Disks, Royal Society, London, UK, 2024
- Poster: *Planetesimal heating from the SLRs ^{60}Fe & ^{26}Al* – Rocky Worlds III, Zürich, Switzerland, 2024
- Poster: *Devolatilization of extrasolar planetesimals by ^{60}Fe and ^{26}Al heating* – Protostars & Planets VII, Kyoto, Japan, 2023

Other

- Doctoral thesis – *Numerical simulations of dusty Colliding Wind Binaries*