James Wurster, Ph.D.

Dunfermline, KY11 8HS, Scotland
email: james.wurster.astro@gmail.com
LinkedIn: www.linkedin.com/in/james-wurster

Citizenship: Canadian; *Permanent residency*: UK
web: jameswurster.bitbucket.io

Highlights of Qualifications

I have a Ph.D. in computational astrophysics and many years of experience performing independent research to solve complex problems; this includes software development and data analysis. My specialisation is in modelling systems of compressible gas in magnetic fields (magneto-fluid dynamics), however my expertise and skills are easily transferable to modelling and analysing any system. I excel at scientific communication, both verbal and written. I work well independently and in groups, and have experience leading research projects and supervising students. I am highly motivated and have excellent time-management skills to meet internal and external deadlines. I am quick and eager to learn new skills, and I am seeking new opportunities and new challenges to which I can apply my highly adaptable skills.

Research and Data Analysis

Research Fellow

(University of St Andrews, 2019-2023; University of Exeter, 2016-2019; Monash University, 2013-2016)

- Develop and lead world-leading astrophysical research projects, using high-performance 3D radiation magneto-hydrodynamics numerical codes; research topics primarily focus on the formation and early evolution of a star and its protoplanetary disc in the presence of non-ideal magnetic fields
- Perform software development to implement new physical and numerical processes into existing numerical codes for more realistic and efficient simulations
- Run simulations on local and national supercomputers (HPC systems); this often includes many simulations per project to investigate an observationally motivated parameter space
- Develop analysis codes to efficiently analyse terabytes of highly variable data
- Analyse and interpret big data to extract ground-breaking results and search for trends; my results included solving a decade-old problem regarding the formation of discs around young stars
- Present results in high-impact peer-reviewed journals and at international conference
- Collaborate on international research projects as a primary investigator and as a contributing scientist
- Supervise students to guide them in their scientific research
- Write research proposals for funding opportunities

Software Development

Research Fellow

(University of St Andrews, 2019-2023; University of Exeter, 2016-2019; Monash University, 2013-2016)

- Developed scientific codes to enable me and others to perform world-leading astrophysical research
- Used the codes I developed for world-leading research, providing me with a unique viewpoint on required development

Developer of the *Phantom* high-performance astrophysical code (phantomsph.bitbucket.io)

- Lead developer (1 of 4) of an international software collaboration of more than 30 developers in 10 countries
- Guide the overall development of the code and provide assistance to the code community
- Development occurred in both an agile/scrum-like environment and independently
- Developed three main classifications of algorithms: physical (for improved realism), numerical (for improved stability), optimisation (for improved performance and user-friendliness)
- Developed and used unit and integration tests for debugging and optimisation
- *Phantom* has been used in over 150 peer-reviewed studies worldwide since 2017

Lead software developer of the *Nicil* magnetohydrodynamics library (bitbucket.org/jameswurster/nicil)

- Designed, developed and documented this open-source code
- *Nicil* is currently integrated into two astrophysical codes; generically designed for implementation in any code
- The code paper has been cited by over a dozen peer-reviewed studies worldwide since 2016

Programming Skills

- **Programmes**: Microsoft Office (including Excel, Powerpoint, Teams & Word), Panopto, Maple
- **Languages**: Fortran, Python, Linux, Bash, MATLAB, IDL, html, LaTeX
- **Distributed computing**: shared- and distributed-memory parallel computing (OpenMP, MPI)
- **Version control**: git, svn

- **HPC job managers**: torque, slurm
- **Automated testing**: unit testing, integration testing
- **Numerical methods**: compressible Smoothed Particle Magnetohydrodynamics, finite volume
- **Numerical algorithms**: single- and multi-fluid (hybrid) models, boundary conditions, sub-grid physics

Communication

Research publications and presentations

- Published 36 peer-reviewed scientific articles (including one invited review article) in high-impact journals; collectively cited over 1320 times
- Presented six invited talks at international workshops in Australia, England, & Scotland, including a 90 minute review talk on smoothed particle magnetohydrodynamics
- Presented 17 contributed talks (10-25 minutes) at international conferences in Australia, England, Greece, Italy, Japan, Scotland, Spain, Taiwan, Vietnam, and virtually 'in' Beirut, USA
- Presented 12 posters at international conferences in Canada, Chile, Cyprus, England, Germany, Greece, Italy, USA, and Wales
- Presented 26 seminars (45 minutes) to physics departments in Australia, Canada, England, Scotland, Sweden, Taiwan, and Wales

Public Outreach

- Volunteered at the Open Night of the observatory at the University of St Andrews
- Presented three public talks to astronomical societies in Canada and Scotland
- Contributed to the public magazine *All About Space*
- Created public videos highlighting important scientific findings (youtube.com/user/WursterAstro)

Technical assistance

- Assisted colleagues and student in understanding, modifying, developing, and debugging numerical algorithms

Leadership

Supervision of students

- Co-supervised Ph.D. (astrophysics) students (University of St Andrews, 2x 2021-2023)
- Supervised M.Phys (astrophysics) students (University of St Andrews, 2019-2020, 2x 2021-2022, 2x 2022-2023)
- Supervised M.Sc. (astrophysics) students (University of St Andrews, 2020, 2020-2021, 2021-2022)
- Supervised an Honours student (Monash University, 2015)
- Supervised two summer students (Monash University, 2015)

Resource Allocation Committees (UK, 2021-2023)

- STFC DiRAC Resource Allocation Committee: Astronomy & Cosmology Sub-Panel. As a member of the UK-wide committee, I organised reviewers for proposals, ranked proposals, and allocated computing time on the DiRAC national computing infrastructure.

Editorships

- Review editor for *Frontiers in Astronomy and Space Sciences - Stellar and Solar Physics* (2022-present)

Equality & Diversity committee member (St Andrews, 2022-2023)

- Contract Research Staff representative on the committee to promote equality and diversity with the School of Physics & Astronomy

Contract Research Staff representative for astrophysics (St Andrews, 2020-2023)

- Liaise between the CRS and the administration at Department and University levels to address and rectify concerns of the CRS
- Organise social events to foster a community amongst the CRS

Conference organisation

- 4th Phantom Users Workshop (Monash University, February 2023): on scientific organising committee
- 14th International SPHERIC Workshop (University of Exeter, June 2019): on local organising committee
- 1st Phantom Users Workshop (Monash University, February 2018): on scientific organising committee

Seminar organisation

- Astronomy Seminar Series (St Andrews, 2021-2023): Invited speakers & organised the weekly online events
- MoCA Public Talk Series (Monash University, 2015-2016): Invited speakers, organised travel & accommodation, booked lecture rooms, and advertised the monthly events
- MoCA Seminar Series (Monash University, 2014): Invited speakers, organised travel & accommodation, booked lecture rooms, and advertised the weekly events

Invited to peer-review manuscripts, proposals, & theses

- Reviewed 25 papers submitted for publication in high-impact astrophysical journals
- Reviewed 3 grant proposals for national funding agencies
- Reviewed 1 PhD thesis

- Manuscripts were accepted or rejected based upon my recommendation; my recommendation influenced the awarding of the grants

Employment

- **Lecturer (Space Physics & Astronomy)**: University of Dundee, Dundee, Scotland (2023)
- **Teaching Assistant (Computational Physics)**: University of St Andrews, St Andrews, Scotland (2022)
- **Guest Lecturer (Contemporary Astrophysics)**: University of St Andrews, St Andrews, Scotland (2021)
- **Co-Lecturer (Fluid Dynamics)**: University of St Andrews, St Andrews, Scotland (2020, 2021); taught both in-class and online
- **Teaching Assistant (Computational Astrophysics)**: University of St Andrews, St Andrews, Scotland (2020); tutored both in-person and online
- **Research Fellow**: University of St Andrews, St Andrews, Scotland (2019-2023)
- **Research Fellow**: University of Exeter, Exeter, England (fixed-term contract: 2016-2019)
- **Lecturer (3rd year Stars & Galaxies)**: Monash University, Melbourne, Australia (2015)
- **Research Fellow**: Monash University, Melbourne, Australia (fixed-term contract: 2013-2016)
- **Laboratory Instructor (Introduction to Physics)**: Saint Mary's University, Halifax, Canada (2012-2013)

Education

- **Ph.D. Astronomy (Computational astrophysics)**: Saint Mary's University, Halifax, Canada (2008-2013)
- **M.Sc. Astronomy (General Relativity)**: Queen's University, Kingston, Canada (2006-2008)
- **B.Sc. (Honours) Mathematics & Physics**: University of Western Ontario, London, Canada (2002-2006)

References

- Available upon request