

Oliver James Hall

ESA Research Fellow - Asteroseismology & Statistics

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skills

Stan, PyMC3, emcee
Bayesian statistics
Hierarchical models
Asteroseismology
Jupyter Notebooks
Popular science writing
Software development
Open-source publication

programming

Python, Git
Unix, LaTeX,
SQL

languages

English, Dutch (bilingual)

open-source code

`lightkurve`
Accessible light curves

`PBJam`
Automated asteroseismology

`michael`
Speedy TESS rotation
periods

positions

- 2020 → now **ESA Research Fellow** European Space Research & Technology Centre, Netherlands
+ Work on Bayesian ensemble analysis problems in asteroseismology and stellar astronomy
+ Develop open-source software to elevate science of current and future ESA missions
+ Run fortnightly *Gaia*-focused meetings with scientists from Leiden University
- 2020 **Freelance Developer** NumFOCUS, TX, USA
+ Developed [training materials for *Kepler* and *K2* users](#) for STScI
+ Worked closely with a global team of collaborators to both write training materials and develop [Lightkurve](#) code

education

- 2016 → 2020 **PhD** in Physics & Astronomy University of Birmingham, UK
+ Supervisor: Dr. Guy R. Davies
+ Thesis: "Ensemble Asteroseismology and Hierarchical Bayesian Models: New Inferences of Astrophysics with Oscillating Stars"
- 2012 → 2016 **M.Sci.** in Physics & Astrophysics University of Birmingham, UK
+ 1st Class w. Honours
+ Dissertation supervisor: Prof. William J. Chaplin
+ Thesis topic: Detecting signatures of stellar activity cycles using asteroseismic frequency shifts
- 2006 → 2012 **Gymnasium** Gemeentelijk Gymnasium Hilversum, The Netherlands
+ 8.5/10 average across eleven subjects

selected presentations

- 2021 Mar **SCI-S Science Seminar** Virtual - ESA
"Hierarchical models and asteroseismic rotation"
- 2021 Mar **SAC Seminar** Virtual - Aarhus University, Denmark
"Hierarchical models and asteroseismic rotation"
- 2020 Feb **CSH Symposium** Centre for Space and Habitability, Switzerland
Invited talk: "Asteroseismology & Rotational Evolution: Bayesian Inference in Stellar Astrophysics"
- 2020 Jan **ESA Research Fellow Jamboree** ESA ESTEC, The Netherlands
"Asteroseismic Follow-Up of *CHEOPS* Target Hosts"
- 2019 Nov **Departmental Seminar** University of Exeter, UK
"Asteroseismology & Applied Statistics"
- 2019 Jul **TASC5/KASC12** MIT, MA, USA
Invited talk: "Accessible Asteroseismology with Lightkurve"
- 2018 Dec **Birmingham-Warwick Science Meet-Up** University of Warwick, UK
"Testing asteroseismology with *Gaia* DR2: Hierarchical Models & the Red Clump"
- 2018 Jul **TASC4/KASC11** Aarhus University, Denmark
"Testing asteroseismology with *Gaia* DR2: Luminosity of the Red Clump"

conferences & workshops

2021 Mar	Cool Stars 20.5	Virtual
2021 Feb	Streams 21 Workshop	Virtual
2020 Dec	SCI Science Workshop 13	Virtual - ESA Internal Workshop
2020 Sep	online.TESS.science	Virtual
2020 Feb	CSH Symposium (invited)	Centre for Space and Habitability, Switzerland
2019 Oct	T'DA 9 (invited)	Institute for Astronomy, HI, USA
2019 Aug	Astro Hack Week 2019	Kavli Institute for Cosmology, UK
2019 Jul	TASC5/KASC12 (invited)	MIT, MA, USA
2019 Jan	T'DA 8	Aarhus University, Denmark
2018 Oct	T'DA 5 (invited)	Ohio State University, OH, USA
2018 Jul	T'DA 4	Aarhus University, Denmark
2018 Jul	TASC4/KASC11	Aarhus University, Denmark
2018 Jun	The Wetton Workshop 2018	University of Oxford, UK
2017 Dec	T'DA 3	KU Leuven, Belgium
2017 Jul	TASC3/KASC10	University of Birmingham, UK
2017 Apr	T'DA 2	Aarhus University, Denmark
2016 Nov	Asteroseismology of stellar activity cycles	Observatoire de la Côte d'Azur, France
2016 Nov	T'DA 1	University of Birmingham, UK

posters

2021 Mar	Cool Stars 20.5 + "New asteroseismic rotation rates of Kepler dwarfs show strong agreement with weakened magnetic braking on the late-age main sequence" + 1-minute video 'haiku' shown during the main programme	Virtual
2020 Dec	SCI Science Workshop 13 + "Characterising the Red Clump standard candle in magnitude, colour, metallicity and alpha abundance" + "New asteroseismic rotation rates of Kepler dwarfs show strong agreement with weakened magnetic braking on the late-age main sequence" + 1-minute videos accompanying both posters	Virtual - ESA Internal Workshop
2019 Jul	TASC5/KASC12 + "Improving gyrochronology of field stars with asteroseismic age and rotation"	MIT, MA, USA
2017 Jul	TASC3/KASC10 + "Mixture Models applied to <i>Kepler</i> backgrounds & development for TESS"	University of Birmingham, UK

research visits

2018 Oct	Visit to the KeplerGO office [3 weeks] + Invited to build the periodogram & seismology modules of Lightkurve .	NASA Ames Research Centre, CA, USA
2018 Jan	Visit to SAC [1 week] + Invited to investigate & build tools for background subtraction of TESS FFIs.	Aarhus University, Denmark

grants & honours

2020 →2022	ESA Research Fellowship	ESA ESTEC, The Netherlands
2019	£815 - Ogden Trust Alumni Fund One-Off Grants	The Ogden Trust, UK
2018	£300 - IOP Research Student Conference Fund (<i>declined</i>)	Institute of Physics, UK
2016	£3000 - Royal Society Partnership Grant	The Royal Society, UK
2015	Teach Physics Outstanding Intern 2015 - shortlisted	The Ogden Trust, UK

teaching & other research

2021	LEAPS 2021 Supervisor + Primary supervisor for student during a 10-week summer program + Jointly ran the selection process, including interviewing a shortlist	Virtual - The Leiden/ESA Astrophysics Program for Summer Students
2021 → now	Student Supervision + Helped advise masters students at the University of Leiden in an unofficial capacity.	Virtual - Leiden University
2019	Advanced HE - Associate Fellow (AFHEA) + Formal acknowledgement of teaching experience and expertise	Advanced HE
2019	Access to Birmingham (A2B) supervisor + Supported applicants from disenfranchised backgrounds through the A2B scheme	University of Birmingham
2017 → 2019	2nd Year Laboratory Projects Demonstrator + Taught students to build apparatus and understand their results + Marked students' work and provided constructive feedback	University of Birmingham, UK
2016 → 2019	3rd Year Observatory Laboratory Supervisor + Supervised students using an observatory and during data reduction + Helped students understand their results as well as the use of IRAF, Unix, and Python	University of Birmingham, UK
2015	Summer Undergraduate Research Experience (SURE) + Performed a six-week project using Python to program a robotic arm system for testing a prototype focal plane for the Cherenkov Telescope Array	University of Leicester, UK
2015	Ogden Trust Teach Physics Intern + Helped teach pupils throughout lessons, acting as a teaching assistant + Prepared and taught a lesson & careers workshop	Bishop Challoner Catholic College, Birmingham, UK

outreach & engagement

2021	Scientist, Skype a Scientist + 2021 Apr - 1st Grade Class, East Lansdowne Elementary, USA + 2021 Jan - USA-based family, 5th, 3rd and Kindergarten grade	Virtual
2021 Apr	Selected Press for Hall et al. 2021 + The Independent - "Old stars are not behaving as expected, scientists say" + Metro - "Stars spin faster as they get older, astronomers learn"	
2021 Mar	Speaker, Astronomy on Tap Leiden A recording of the talk is available online .	Leiden, The Netherlands
2019 → 2021	Author, Astrobites Collaboration + Wrote and edited monthly summaries of astronomy papers at an undergraduate level. + Committee member for Advertising, Moderating, Hiring, Undergraduate Engagement , and Equality, Diversity & Inclusion + Wrote a total of 14 articles over a 2 year period + Article featured in AAS Nova - "Cosmic Archaeology from an Ancient Pulsating Star"	
2019	Developer, State of The Universe collaboration + Helped build and maintain an informative package for teachers and planetarium guides	Astro Hack Week 2019
2018 → 2019	Demonstrator, Applicant Visit Days + Developed and taught laboratory sessions for undergraduate applicants	University of Birmingham, UK
2016 → 2017	Partnered Researcher, Royal Society Partnership Grant + Developed and taught a series of lessons and lab activities engaging Year 9 pupils with exoplanet characterisation and asteroseismology	Bishop Challoner Catholic College, UK

community services

2020 →now	Organiser, LEAPS 2021 Summer Student Programme + Worked with researchers at the University of Leiden and ESA to organise a virtual summer research programme for a cohort of 21 students across the globe + Organised twice-weekly seminars and workshops in conjunction with the Amsterdam-based ASPIRE programme	Virtual - ESA ESTEC/Leiden University
2021	Panelist, TESS Cycle 4 + Collaborated virtually with a global team of panelists to rank research proposals	Virtual - NASA Goddard
2020 →now	Scientific Reviewer, ESA/NASA Hubble Space Telescope + Scientific review of papers for potential press releases and the Hubble Picture of the Day	ESA ESTEC, The Netherlands
2020 →now	Reviewer + For The Astrophysical Journal	
2020	LOC, SCI Science Workshop 13 + Organised poster viewing and social gatherings in Gather Town + Moderated speaker sessions	Virtual - ESA Internal Workshop
2018 →2019	Organiser, 9th BEAR Conference + Organised local annual high performance computing conference	University of Birmingham, UK
2017	LOC, TASC3/KASC11 + Helped organise 150+ attendee asteroseismology conference	University of Birmingham, UK
2021 →now	Member of the <i>International Astronomical Union (IAU)</i>	
2018 →now	Member of the Lightcurve collaboration	NASA Ames Research Centre, CA, USA
2016 →now	Member of the <i>TESS Data for Asteroseismology (T'DA)</i> collaboration	
2016 →now	Member of the <i>TESS Asteroseismic Science Consortium (TASC)</i>	

selected publications

14 publications, of which 2 as first author, with 302 total citations. **H-index: 9**

first & second author publications:

1. **Hall, O. J.**, Davies, G. R., van Saders, J. and 9 coauthors
Weakened magnetic braking supported by asteroseismic rotation rates of Kepler dwarfs
Nature Astronomy, 2021
Summary: Made new measurements of asteroseismic rotation rates, and compared these to population models of rotational evolution to indicate the presence of weakened magnetic braking.
[doi:10.1038/s41550-021-01335-x](#), [arXiv:2104.10919](#)
2. **Hall, O. J.**, Davies, G. R., Elsworth, Y. P. and 9 coauthors
Testing asteroseismology with Gaia DR2: Hierarchical models of the Red Clump
Monthly Notices of the Royal Astronomical Society, **2019**
Summary: Constrained the luminosity of the Red Clump and the *Gaia* DR2 parallax zero-point offset simultaneously using hierarchical latent variable models.
[doi:10.1093/mnras/stz1092](#), [arXiv:1904.07919](#)
3. Khan, S., **Hall, O. J.**, Miglio, A., Davies, G. R., Mosser, B., Girardi, L., Montalbán, J.
The Red-giant Branch Bump Revisited: Constraints on Envelope Overshooting in a Wide Range of Masses and Metallicities
The Astrophysical Journal, **2018**
Contribution: Used Mixture Models to constrain the position of the Red-Giant Branch Bump.
[doi:10.3847/1538-4357/aabf90](#), [arXiv:1804.06669](#)

contributing author publications:

4. Montalbán, J., Mackereth, J. T., Miglio, A. and 16 coauthors including **Hall, O. J.**
Chronologically dating the early assembly of the Milky Way
Accepted, **Nature Astronomy, 2021**
Contribution: Obtained seismic parameters for stellar sample and helped develop hierarchical model.
[arxiv:2001.04653](#)
5. Mackereth, J. T., Miglio, A., Elsworth, Y., and 30 coauthors including **Hall, O. J.**
Prospects for Galactic and stellar astrophysics with asteroseismology of giant stars in the TESS continuous

viewing zones and beyond

Monthly Notices of the Royal Astronomical Society, **2021**

Contribution: Obtained fundamental seismic parameters for stellar sample.

[doi:10.1093/mnras/stab098](https://doi.org/10.1093/mnras/stab098), [arXiv:2012.00140](https://arxiv.org/abs/2012.00140)

6. Nielsen, M. B., Davies, G. R., Ball, W. H., Lyttle, A. J., Li, T., **Hall, O. J.** and 11 other coauthors
PBJam: A Python Package for Automating Asteroseismology of Solar-like Oscillators
The Astronomical Journal, **2021**
Contribution: Developed code and documentation for PBJam package
[doi:10.3847/1538-3881/abcd39](https://doi.org/10.3847/1538-3881/abcd39), [arXiv:2012.00580](https://arxiv.org/abs/2012.00580)
7. Silva Aguirre, V., Stello, D., Stokholm, A. and 75 coauthors including **Hall, O. J.**
Detection and characterisation of oscillating red giants: first results from the TESS satellite
The Astrophysical Journal, **2020**
Contribution: Obtained fundamental seismic parameters for stellar sample.
[doi:10.3847/2041-8213/ab6443](https://doi.org/10.3847/2041-8213/ab6443), [arXiv:1912.07604](https://arxiv.org/abs/1912.07604)
8. Chaplin, W., Serenelli, A. M., Miglio, A. and 83 coauthors including **Hall, O. J.**
Age dating of an early Milky Way merger via asteroseismology of the naked-eye star ν Indi
Nature Astronomy, **2020**
Contribution: Advised on systematic uncertainties in spectroscopic methods.
[doi:10.1038/s41550-019-0975-9](https://doi.org/10.1038/s41550-019-0975-9), [arXiv:2001.04653](https://arxiv.org/abs/2001.04653)
9. Huber, D., Chaplin, W. J., Chontos, A and 139 coauthors including **Hall, O. J.**
A Hot Saturn Orbiting An Oscillating Late Subgiant Discovered by TESS
The Astronomical Journal, **2019**
Contribution: Checked proper use and interpretation of *Gaia* parallaxes.
[doi:10.3847/1538-3881/ab1488](https://doi.org/10.3847/1538-3881/ab1488), [arXiv:1901.01643](https://arxiv.org/abs/1901.01643)
10. Bugnet, L., García, R. A., Mathur, S., Davies, G. R., **Hall, O. J.**, Lund, M. N., Rendle, B. M.
FliPer_{Class}: In search of solar-like pulsators among TESS targets
Astronomy & Astrophysics, **2019**
Contribution: Aided with interpretation of systematic uncertainties on effective temperature.
[doi:10.1051/0004-6361/201834780](https://doi.org/10.1051/0004-6361/201834780), [arXiv:1902.09854](https://arxiv.org/abs/1902.09854)
11. Bugnet, L., García, R. A., Davies, G. R., Mathur, S., Corsaro, E., **Hall, O. J.**, Rendle, B. M.
FliPer: A global measure of power density to estimate surface gravities of main-sequence solar-like stars and red giants
Astronomy & Astrophysics, **2018**
Contribution: Helped develop the FliPer metric & its machine learning implementation.
[doi:10.1051/0004-6361/201833106](https://doi.org/10.1051/0004-6361/201833106), [arXiv:1809.05105](https://arxiv.org/abs/1809.05105)
12. Davies, G. R., Lund, M. N., Miglio, A., Elsworth, Y. P. and 13 coauthors including **Hall, O. J.**
Using red clump stars to correct the Gaia DR1 parallaxes
Astronomy & Astrophysics, **2017**
Contribution: Verified results found by lead authors.
[doi:10.1051/0004-6361/201630066](https://doi.org/10.1051/0004-6361/201630066), [arXiv:1701.02506](https://arxiv.org/abs/1701.02506)

software publications:

13. Lightkurve Collaboration, Cardoso, J. V. d. M., Hedges, C., Gully-Santiago, M., Saunders, N., Cody, A-M., Barclay, T., **Hall, O. J.**, Sagar, S., Turtelboom, E., Zhang, J., Tzanidakis, A., Mighell, K., Coughlin, J., Bell, K., Berta-Thompson, Z., Williams, P., Dotson, J., Barentsen, G.
Lightkurve: Kepler and TESS time series analysis in Python
Astrophysics Source Code Library, **2018**
Contribution: Led development of the 'periodogram' and 'seismology' modules.
[ascl:1812.013](https://ascl.net/1812.013)

white papers:

14. Khullar, G., Kholer, S., Konchady, T. and 32 coauthors including **Hall, O. J.**
Astrobites as a Community-led Model for Education, Science Communication, and Accessibility in Astrophysics
arXiv e-prints, **2019**
[arXiv:1907.09496](https://arxiv.org/abs/1907.09496)