

# Oliver James Hall

## ESA Research Fellow - Asteroseismology & Statistics

### coordinates

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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, HTML

### 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  
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  
+ 1<sup>st</sup> 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, 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"  
Poster: "Improving gyrochronology of field stars with asteroseismic age and rotation"  
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 ( <b>invited</b> )	Centre for Space and Habitability, Switzerland
2019 Oct	T'DA 9 ( <b>invited</b> )	Institute for Astronomy, HI, USA
2019 Aug	Astro Hack Week 2019	Kavli Institute for Cosmology, UK
2019 Jul	TASC5/KASC12 ( <b>invited</b> )	MIT, MA, USA
2019 Jan	T'DA 8	Aarhus University, Denmark
2018 Oct	T'DA 5 ( <b>invited</b> )	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.	<b>Cool Stars 20.5</b>	Virtual
	+ "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	
2020 Dec.	<b>SCI Science Workshop 13</b>	Virtual - ESA Internal Workshop
	+ "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	
2019 Jul.	<b>TASC5/KASC12</b>	MIT, MA, USA
	+ "Improving gyrochronology of field stars with asteroseismic age and rotation"	
2017 Jul.	<b>TASC3/KASC10</b>	University of Birmingham, UK
	+ "Mixture Models applied to <i>Kepler</i> backgrounds & development for TESS"	

## research visits

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

## grants & honours

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

## teaching & other research

2021	<b>LEAPS 2021 Supervisor</b> + 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	<b>Student Supervision</b> + Helped advise masters students at the University of Leiden in an unofficial capacity.	Virtual - Leiden University
2019	<b>Advanced HE - Associate Fellow (AFHEA)</b> + Formal acknowledgement of teaching experience and expertise	Advanced HE
2019	<b>Access to Birmingham (A2B) supervisor</b> + Supported applicants from disenfranchised backgrounds through the A2B scheme	University of Birmingham
2017 → 2019	<b>2<sup>nd</sup> Year Laboratory Projects Demonstrator</b> + Taught students to build apparatus and understand their results + Marked students' work and provided constructive feedback	University of Birmingham, UK
2016 → 2019	<b>3<sup>rd</sup> Year Observatory Laboratory Supervisor</b> + 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	<b>Summer Undergraduate Research Experience (SURE)</b> + 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	<b>Ogden Trust Teach Physics Intern</b> + 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	<b>Scientist, Skype a Scientist</b> + 2021 Apr - 1st Grade Class, East Lansdowne Elementary, USA + 2021 Jan - USA-based family, 5th, 3rd and Kindergarten grade	Virtual
2021 Apr	<b>Selected Press for Hall et al. 2021</b> + The Independent - "Old stars are not behaving as expected, scientists say" + Metro - "Stars spin faster as they get older, astronomers learn"	
2021 Mar	<b>Speaker, Astronomy on Tap Leiden</b> A recording of the talk is <a href="#">available online</a> .	Leiden, NL
2019 → 2021	<b>Author, Astrobites Collaboration</b> + Wrote and edited monthly summaries of astronomy papers at an undergraduate level. Committee member for <b>Advertising, Moderating, Hiring, Undergraduate Engagement</b> , and <b>Equality, Diversity &amp; Inclusion</b> + Wrote a total of 13 articles over a 2 year period + Article featured in AAS Nova - "Cosmic Archaeology from an Ancient Pulsating Star"	
2019	<b>Developer, State of The Universe collaboration</b> + Helped build and maintain an informative package for teachers and planetarium guides.	Astro Hack Week 2019
2018 → 2019	<b>Demonstrator, Applicant Visit Days</b> + Developed and taught laboratory sessions for undergraduate applicants.	University of Birmingham, UK
2016 → 2017	<b>Partnered Researcher, Royal Society Partnership Grant</b> + 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

2021	<b>Panelist, TESS Cycle 4</b> + Collaborated virtually with a global team of panelists to rank research proposals	Virtual - NASA Goddard
2020 → now	<b>Reviewer</b> + For The Astrophysical Journal	
2020	<b>LOC, SCI Science Workshop 13</b> + Organised poster viewing and social gatherings in <a href="#">Gather Town</a> + Moderated speaker sessions	Virtual - ESA Internal Workshop
2018 → 2019	<b>Organiser, 9<sup>th</sup> BEAR Conference</b> + Organised local annual high performance computing conference.	University of Birmingham, UK
2017	<b>LOC, TASC3/KASC11</b> + Helped organise 150+ attendee asteroseismology conference.	University of Birmingham, UK
2018 → now	Member of the <b>Lightcurve</b> collaboration	NASA Ames Research Centre, CA, USA
2016 → now	Member of the <i>TESS Data for Asteroseismology (T<sup>2</sup>DA)</i> collaboration	
2016 → now	Member of the <i>TESS Asteroseismic Science Consortium (TASC)</i>	
2016 → now	Member of the <i>International Astronomical Union (IAU)</i>	

## selected publications

20 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](#), [arXiv: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  $\nu$ 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<sub>Class</sub>: 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)