Oliver James Hall

ESA Research Fellow - Asteroseismology & Statistics

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skills

NumPyro, PyMC3
JAX, Stan, emcee
Bayesian statistics
Hierarchical models
Machine Learning
Asteroseismology
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

history

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 Observatory

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

2016 →2020 **PhD** in Physics & Astronomy University of Birmingham, UK
+ Supervisor: Dr. Guy R. Davies

2012 →2016 **M.Sci.** in Physics & Astrophysics University of Birmingham, UK
+ 1st Class w. Honours
+ Dissertation supervisor: Prof. William J. Chaplin

2006 →2012 **Gymnasium** Gemeentelijk Gymnasium Hilversum, The Netherlands

teaching & supervision

2021 **LEAPS 2021 Supervisor** The Leiden/ESA Astrophysics Program for Summer Students
+ Primary supervisor for student during a 10-week summer program
+ Jointly ran the selection process, including interviewing a shortlist

2021 **Ran LEAPS Workshop: "Best Coding Practices"** Virtual - Leiden Observatory
+ Learning materials available on GitHub.

2021 →now **Student Supervision** Virtual - Leiden Observatory
+ Co-advisor on a LEAPS 2022 project.
+ Co-advised a masters students at the University of Leiden in 2021.

2019 **Advanced HE - Associate Fellow (AFHEA)** Advanced HE
+ Formal acknowledgement of teaching experience and expertise

2019 **Access to Birmingham (A2B) supervisor** University of Birmingham
+ Supported applicants from disenfranchised backgrounds through the A2B scheme

2017 →2019 **2nd Year Laboratory Projects Demonstrator** University of Birmingham, UK
+ Taught students to build apparatus and understand their results
+ Marked students' work and provided constructive feedback

2016 →2019 **3rd Year Observatory Laboratory Supervisor** University of Birmingham, UK
+ Supervised students using an observatory and during data reduction
+ Helped students understand their results as well as the use of IRAF, Unix, and Python

2015 **Ogden Trust Teach Physics Intern** Bishop Challoner Catholic College, Birmingham, UK
+ Helped teach pupils throughout lessons, acting as a teaching assistant
+ Prepared and taught a lesson & careers workshop

selected presentations

2021 Nov — **SCI Science Workshop 14** — Remote Hybrid - ESA ESAC, Spain
"TESS-Gaia synergy: automating rotation measurements for new Hyades stellar stream members"

2021 Oct — **8th Iberian Meeting on Asteroseismology** — Virtual
"Weakened magnetic braking supported by asteroseismic rotation rates of Kepler dwarfs"

2021 Jun — **Nordic Dynamo Seminar** — Virtual - Stockholm University
"Weakened magnetic braking supported by asteroseismic rotation rates of Kepler dwarfs"

2021 Jun — **Gaia EDR3 Early Science and Best Practices - Invited talk** — Virtual
"Synergies between Gaia and asteroseismology in EDR3"

2021 Mar — **SAC Seminar** — Virtual - Aarhus University, Denmark
"Hierarchical models and asteroseismic rotation"

2020 Feb — **CSH Symposium - Invited talk** — Centre for Space and Habitability, Switzerland
"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 - Invited talk** — MIT, MA, USA
"Accessible Asteroseismology with Lightkurve"

2018 Jul — **TASC4/KASC11** — Aarhus University, Denmark
"Testing asteroseismology with *Gaia* DR2: Luminosity of the Red Clump"

outreach & engagement

2021 — ***Scientist*, Skype a Scientist** — Virtual
+ 2021 Jun - Two classes aged 8-11, Newtown Primary School, UK
+ 2021 Apr - 1st Grade Class, East Lansdowne Elementary, USA
+ 2021 Jan - USA-based family, 5th, 3rd and Kindergarten grade

2021 — ***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 — ***Speaker*, Astronomy on Tap Leiden** — Leiden, The Netherlands
A recording of the talk is **available online.**

2019 →2021 — ***Author*, Astrobites Collaboration**
+ 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** — Astro Hack Week 2019
+ Helped build and maintain an informative package for teachers and planetarium guides

2018 →2019 — ***Demonstrator*, Applicant Visit Days** — University of Birmingham, UK
+ Developed and taught laboratory sessions for undergraduate applicants

2016 →2017 — ***Partnered Researcher*, Royal Society Partnership Grant** — Bishop Challoner Catholic College, UK
+ Developed and taught lessons engaging Year 9 pupils with exoplanets and asteroseismology.

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 *(declined)* — Institute of Physics, UK
2016 — **£3000** - Royal Society Partnership Grant — The Royal Society, UK
2015 — Teach Physics Oustanding Intern 2015 - shortlisted — The Ogden Trust, UK

conferences & workshops

2021 Nov	SCI Science Workshop 14	Remote Hybrid - ESA ESAC, Spain
2021 Oct	8th Iberian Meeting on Asteroseismology	Virtual
2021 Jun	EAS Annual Meeting	Virtual
2021 Jun	Gaia EDR3 Early Science and Best Practices (**invited**)	Virtual
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 Institude 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

selected posters

2021 Jun — **EAS Annual Meeting** — Virtual
+ TESS-Gaia Synergy: Gyrochronology of new Hyades tidal tail members

2021 May — **ESA Young Persons Event 2021** — Virtual
+ Age-dating the Hyades tidal tail: Testing Gaia astrometrics with TESS

2021 Mar — **Cool Stars 20.5** — 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 — **SCI Science Workshop 13** — 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 — **TASC5/KASC12** — MIT, MA, USA
+ "Improving gyrochronology of field stars with asteroseismic age and rotation"

2017 Jul — **TASC3/KASC10** — University of Birmingham, UK
+ "Mixture Models applied to *Kepler* backgrounds & development for TESS"

research visits

2018 Oct — **Visit to the KeplerGO office [3 weeks]** — NASA Ames Research Centre, CA, USA
+ Invited to build the **periodogram** & **seismology** modules of **Lightkurve**.

2018 Jan — **Visit to SAC [1 week]** — Aarhus University, Denmark
+ Invited to investigate & build tools for background subtraction of TESS FFIs.

community services

2020 →2021 ***Organiser*, LEAPS 2021 Summer Student Programme** Virtual - ESA ESTEC/Leiden University
+ 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

2021 ***Panelist*, TESS Cycle 4** Virtual - NASA Goddard
+ Collaborated virtually with a global team of panelists to rank research proposals

2020 →now ***Scientific Reviewer*, ESA/NASA Hubble Space Telescope** ESA ESTEC, The Netherlands
+ Scientific review of papers for potential press releases and the Hubble Picture of the Day

2020 →now ***Reviewer* for:**
+ Nature Astronomy
+ The Astrophysical Journal

2020 →now **Conference Session Chair** Various
+ SSW13, SSW14

2020 ***LOC*, SCI Science Workshop 13** Virtual - ESA Internal Workshop
+ Organised poster viewing and social gatherings in Gather Town

2018 →2019 ***Organiser*, 9th BEAR Conference** University of Birmingham, UK
+ Organised local annual high performance computing conference

2017 ***LOC*, TASC3/KASC11** University of Birmingham, UK
+ Helped organise 150+ attendee asteroseismology conference

2021 →now Member of the *International Astronomical Union* (IAU)
2018 →now Member of the **Lightkurve** collaboration NASA Ames Research Centre, CA, USA
2016 →now Member of the *TESS Data for Asteroseismology* (**T'DA**) collaboration
2016 →now Member of the *TESS Asteroseismic Science Consortium* (TASC)

selected publications

18 publications, of which 2 as first author. **H-index: 10**

first, second & third 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. Masuda, K, Petigura, A. E, **Hall, O. J.**
Inferring the Rotation Period Distribution of Stars from their Projected Rotation Velocities and Radii: Application to late-F/early-G Kepler Stars
Monthly Notices of the Royal Astronomical Society, **2021**
Contribution: Data and analysis for the implications for magnetic braking, supported the development of the statistical models.
arXiv:2112:07162

4. 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:

5. Lund, M. N, Handberg, R, Buzasi, D. L, Carboneau, L, **Hall, O. J.** and 6 other coauthors
   TESS Data for Asteroseismology: Light-curve Systematics Correction
   The Astrophysical Journal Supplement Series, **2021**
   Contribution: Development of open-source data pipeline andensemble systematics correction.
   doi:10.3847/1538-4365/ac214a, arXiv:2108:11780

6. Handberg, R, Lund, M. N, White, T. R, **Hall, O. J.** and 11 other coauthors
   TESS Data for Asteroseismology: Photometry
   The Astronomical Journal, **2021**
   Contribution: Development of background removal algorithm.
   doi:10.3847/1538-3881/ac09f1 , arXiv:2106:08341

7. Lyttle, A. J, Davies, G. R, Li, T. and 9 coauthors including **Hall, O. J.**
   Hierarchically modelling Kepler dwarfs and subgiants to improve inference of stellar properties with asteroseismology
   Monthly Notices of the Royal Astronomical Society, **2021**
   Contribution: Contributed to the development of the hierarchical models.
   doi:10.1093/mnras/stab1368, arxiv:2105.04482

8. Montalbán, J, Mackereth, J. T, Miglio, A. and 16 coauthors including **Hall, O. J.**
   Chronologically dating the early assembly of the Milky Way
   Nature Astronomy, **2021**
   Contribution: Obtained seismic parameters for stellar sample and helped develop hierachical model.
   doi:10.1038/s41550-021-01347-7 ,arxiv:2001.04653

9. 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

10. 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, arXiv:2012.00580

11. 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, arXiv:1912.07604

12. 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 νIndi
    Nature Astronomy, **2020**
    Contribution: Advised on systematic uncertainties in spectroscopic methods.
    doi:10.1038/s41550-019-0975-9, arXiv:2001.04653

13. 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, arXiv:1901.01643

14. 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, arXiv:1902.09854

15. 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:0.1051/0004-6361/201833106, arXiv:1809.05105

16. 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, arXiv:1701.02506

software publications:

17. Lightkurve Collaboration, Cardoso, J. V. d. M, Hedges, C, Gully-Santiago, M, Saunders, N, Cody, A-M, Barclay, T, **Hall, O. J**, Sagear, 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

white papers:

18. 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