David J. Armstrong

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Employment

Mar 2017 - **Research Fellow**, *University of Warwick, UK*.
Funded on the STFC consolidated grant to work on the NGTS project.

Sep 2015 - Feb 2017 **Research Fellow**, *Queens University Belfast, UK*.
Applying machine learning techniques to the problem of planet detection.

Nov 2014 - Sep 2015 **Postdoc Position**, *University of Warwick, UK*.
Detrending K2 satellite data to detect previously unknown planets and variable stars.

Education

2011–2014 **PhD Astrophysics**, *University of Warwick, UK*.
Thesis: The Population of Circumbinary Planets in the Kepler Dataset
One year of course studied at Queens University Belfast, UK

2007–2011 **Masters in Physics**, *University of Oxford, UK*, 1st Class.
Masters specialisation in Astrophysics and Atmospheric Physics

Research Highlights

Publications	40 refereed publications in internationally recognised high impact journals including 10 as first author. 415 citations. H-index of 11.
Machine Learning	Use of Random Forests and Self Organising Maps to identify, classify and vet planets and variable stars in Kepler and K2 data using fast automated methods.
Planet Populations	The first observational proof that circumbinary planets are at least as common as exoplanets orbiting single stars. Statistical determination of the underlying circumbinary planet population using injection recovery tests and population synthesis to quantify the occurrence rate.
Planet Detection	Creation of custom planet detection routines for both usual and atypical planets, including planets with transit timing variations and planets only transiting once during the data. This resulted in multiple new planetary detections, with masses from radial velocity follow-up, from the K2 mission.
Detrending	Development of a detrending pipeline for K2 data, well-known and still used by the community.
Atmospheres	Utilising Kepler data to find the first evidence of temporal variability in a Hot Jupiter atmosphere, through searching for variability in the reflected light from the planet.
Habitability	Detection of superflares from the host star of the Earth-like planet Kepler-438b. Interdisciplinary research in Habitability through collaboration with academics university wide.

Scientific Responsibilities and Collaborations

Invited member of NASA TESS mission TASC working group 0 (lightcurve preparation)

Member of ISSI International Team led by Juan Cabrera, "Researching the diversity of planetary systems"

Member of the SuperWASP and NGTS collaborations

Warwick lead for the HARPS-K2 Large follow-up program

Active research collaborations with academics at Aarhus, Geneva, Marseilles and Porto.

Collaboration with Warwick Computer Science, jointly supervising a student working on machine learning for exoplanet vetting.

Teaching Experience

Supervision

Co-supervision of MSc research student *Jevgenij Gamper*, 2017. Exploring novel machine learning techniques to improve planet detection and classification.

Co-supervision of Masters student research project, *Taimur Siddiq*, 2016. Using machine learning techniques to find anomalous planet signals in time-series data.

URSS undergraduate summer research project supervision, *James Blake*, 2015, 2016, 2017.

Teaching

Convenor of a proposed Warwick interdisciplinary postgraduate module, "Habitability in the Universe". To be taught in Spring 2018.

Guest lecture to Warwick biology class on Exoplanets and Habitability, Nov 2016

Demonstrating Python programming to undergraduates, Warwick, 2015–2016

Teaching 1st year laboratory skills, Warwick, 2012–2014

Demonstrating C programming and application, QUB, 2011–2012

Communication and Outreach

Invited Talks Invited to present at 9 seminars/workshops. See Publication list.

Conferences Presented talks and posters at multiple national and international conferences. See Publication list.

Media Issued press release on superflares impacting Kepler-438b's habitability, reaching 100s of media outlets internationally (2015). Issued press release on the first discovery of weather in a Hot Jupiter atmosphere (2017), reaching several hundred news outlets.

Radio Interviewed by BBC Radio 4 regarding Hot Jupiter weather (2017). Interviews for Radio Austria and USA Today regarding the detection of Proxima Centauri b (2016).

Outreach Multiple talks to school students, including Kings High School (Feb 2017), PHYS-X (Dec 2014, Jun 2017)

Organised several Habitability inspired outreach events, including a poster competition and interview of the sci-fi author Alasdair Reynolds.

Science consultant for an engineering department student project at Warwick (WUSAT), aimed at designing, creating and launching a nano-satellite research device via the EU REXUS program.

Management/Administration

Deputy Director of the Centre for Exoplanets and Habitability at Warwick, bringing academics from 7 university departments together for teaching, seminars, grant applications and outreach.

Seminar organiser for the Astronomy group seminar series, 2014–2017

Session organiser and chair for Exoplanets session at NAM2016

Refereeing

Referee Expert referee for Nat. Astro, ApJ, MNRAS, and PASP

Reviewer Invited, NASA Exoplanet Research Program Panel, 2016, 2017

NKFIH Hungarian Science Foundation Grants, 2016, 2017

Opticon panel external reviewer, Semester 17A

PATT Telescope proposals, Semester 16B, 17B

Proposals

ESO HARPS-K2 Large Program P98, 70 nights awarded over 4 semesters for K2 followup (PI Santerne)

ESO HARPS P96, 8 nights awarded for K2 followup (PI Santerne)

Opticon HARPS-N 15B, 3 nights awarded for K2 followup (PI Santerne)

WHT/Ultracam, 4 nights May 2015, "Measuring the tidal decay of northern WASP hot Jupiters through transit timing" (PI Brown)

EU REXUS program, place awarded on rocket launch for WUSAT project, 2014 (Science PI Armstrong)

WHT/ISIS service time awarded, Aug 2012 and June 2014, "A new circumbinary terrestrial planet from Kepler Data" (PI Armstrong)

NOT/FIES service time awarded, Jan 2012 and Aug 2012 (PI Armstrong)

Grants

STFC Consolidated Grant, 2017

Pedagogic Intervention grant awarded for Habitability Centre development, 2016

ISSI "Researching the Diversity of planetary systems": Grant for two meetings and collaboration, 2016

Lord Rootes Memorial Fund: Grant for research project in Nepal, 2014

Queens University Belfast/University of Warwick: PhD Studentship, 2012–2015

Publication List

Publications in peer-reviewed journals (Total 40, 6 of which under review. 10 as first author. H-index=11. Total citations=415)

As First Author:

1. **Armstrong, D J** et al, *MNRAS*, 465, 2634, "Transit Shapes and Self Organising Maps as a Tool for Ranking Planetary Candidates: Application to *Kepler* and *K2*" (2017)
2. **Armstrong, D J** et al, ***Nature Astronomy***, 1, 4, "Changing Weather Patterns in the Atmosphere of the Exoplanet HAT-P-7b" (2016)
3. **Armstrong, D J** et al, *MNRAS*, 456, 2260, "K2 Variable Catalogue II: Machine learning classification of variable stars and eclipsing binaries in K2 Fields 0-4" (2016)
4. **Armstrong, D J** et al, *MNRAS*, 455, 3110, "The host stars of Kepler's Habitable Exoplanets: superflares, rotation and activity" (2016)
5. **Armstrong, D J** et al, *A&A*, 582, 33, "One of the closest planet pairs to the 3:2 Mean Motion Resonance: K2-19b and c" (2015)
6. **Armstrong, D J** et al, *A&A*, 579, 19, "K2 Variable Catalogue: Variable Stars and Eclipsing Binaries in K2 Campaigns 1 and 0" (2015)
7. **Armstrong, D J** et al, *MNRAS*, 444, 1873, "On the abundance of circumbinary planets" (2014)
8. **Armstrong, D J** et al, *MNRAS*, 437, 3472, "A catalogue of temperatures for Kepler eclipsing binary stars" (2014)
9. **Armstrong, D J** et al, *MNRAS*, 434, 3047, "Placing limits on the transit timing variations of circumbinary exoplanets" (2013)
10. **Armstrong, D J** et al, *A&A Letters*, 545, L4, "A transiting companion to the eclipsing binary KIC002856960" (2012)

As Co-author:

11. Santerne, A, Brugger, B, **Armstrong, D J** et al, ***Nature Astronomy***, "An Earth-size exoplanet with a Mercury-like composition" (2017, submitted)
12. Giles, H A C et al, *MNRAS*, "EPIC 228735255b – An eccentric, 6.57 day transiting hot Jupiter in Virgo" (2017, submitted
13. Veras, D, **Armstrong, D J** et al, *Astrobiology*, "Dynamical and Biological Panspermia Constraints Within Multi-planet Exosystems" (2017, submitted)
14. Brown, D J A et al, *A&A*, "Three Planet Discoveries from the Wide Angle Search for Planets: WASP-85Ab; WASP-116b, and WASP-149b" (2017, submitted)
15. Barros, S C C et al, *A&A*, "Precise masses for the transiting planetary system HD 106315 with HARPS" (2017, submitted)
16. Faedi, F et al, *A&A*, "WASP-86b and WASP-102b: super-dense versus bloated planets" (2017, submitted)
17. Cabrera, J, Barros, S C C, **Armstrong, D J** et al, *A&A*, "Disproval of the validated planets K2-78b, K2-82b, and K2-92b" (2017, in press)
18. Gunther, M N et al, *MNRAS*, "Centroid vetting of transiting planet candidates from the Next Generation Transit Survey" (2017, in press)

19. Osborn, H P et al, *MNRAS*, 471, 740, “Periodic Eclipses of the Young Star PDS 110 Discovered with WASP and KELT Photometry” (2017)
20. Lam, K W F et al, *A&A*, 599, A3, “From Dense Hot Jupiter to Low Density Neptune: The Discovery of WASP-127b, WASP-136b and WASP-138b” (2017)
21. Osborn, H P et al, *A&A*, 604, A19, “K2-110b: a massive mini-Neptune exoplanet (2017)
22. Bayliss, D et al, *AJ*, 153, 15, “EPIC201702477b: A Long Period Transiting Brown Dwarf from K2” (2017)
23. Kirk, J et al, *MNRAS*, 463, 2922, “Transmission spectroscopy of the inflated exoplanet WASP-52b, and evidence for a bright region on the stellar surface” (2016)
24. Lillo-box, J et al, *A&A*, 594, A50, “K2-30b and K2-34b: two inflated hot-Jupiters around Solar-type stars” (2016)
25. Barros, S C C et al, *A&A,* 593, A113, " WASP-113b and WASP-114b, two inflated hot Jupiters with contrasting densities" (2016)
26. Pugh, C P, **Armstrong, D J** et al, *MNRAS*, 459, 3659, “Statistical Properties of Quasi-Periodic Pulsations in White-Light Flares Observed With Kepler” (2016)
27. Santerne, A at el, *ApJ*, 824, 55 “K2-29b/WASP-152b: An Aligned And Inflated Hot Jupiter In A Young Visual Binary” (2016)
28. Osborn, H P, **Armstrong D J** et al, *MNRAS*, 457, 2273, “Single transit candidates from K2: Detection and period estimation” (2016)
29. Spake, J J et al, *PASP*, 128, 024401, “WASP-135b: a highly irradiated, inflated hot Jupiter orbiting a G5V star” (2016)
30. Barros, S C C et al, *MNRAS*, 454, 4267, “Photodynamical mass determination of the multiplanetary system K2-19” (2015)
31. Hermes, J J et al, *ApJ*, 810, 5, “A Second Case of Outbursts in a Pulsating White Dwarf Observed by Kepler” (2015)
32. Hermes, J J et al, *MNRAS* 451, 1701, "Insights into internal effects of common-envelope evolution using the extended Kepler mission" (2015)
33. Smith, A et al, *A&A*, 570, A64, "WASP-104b and WASP-106b: two transiting hot Jupiters in 1.75-day and 9.3-day orbits" (2014)
34. Marsh, T, **Armstrong, D J**, and Carter, P, *MNRAS*, 445, 309, "KIC 2856960: the impossible triple star" (2014)
35. Brothwell, R D et al, *MNRAS*, 440, 3392, "A window on exoplanet dynamical histories: Rossiter-McLaughlin observations of WASP-13b and WASP-32b" (2014)
36. Galperin, B et al, *Icarus*, 229, 295, "Cassini observations reveal a regime of zonostrophic macroturbulence on Jupiter" (2014)
37. Gomez Maqueo Chew, Y et al, *A&A*, 559, A36, "Discovery of WASP-65b and WASP-75b: Two hot Jupiters without highly inflated radii" (2013)
38. Faedi, F et al, *A&A*, 551, A73, "WASP-54b, WASP-56b, and WASP-57b: Three new sub-Jupiter mass planets from SuperWASP" (2013)
39. Hebrard, G et al, *A&A*, 549, A134, "WASP-52b, WASP-58b, WASP-59b, and WASP-60b: Four new transiting close-in giant planets" (2013)
40. Bonfils, X et al, *A&A*, 546, A27, "A hot Uranus transiting the nearby M dwarf GJ 3470. Detected with HARPS velocimetry. Captured in transit with TRAPPIST photometry" (2012)

Other Publications

41. **Armstrong, D J**, AAS, ESS meeting #3 Conf. Proc., "The Abundance of Circumbinary Exoplanets" (2015)
42. Brown, D J A and **Armstrong, D J**, EPSC2015-588 Conf. Proc., "Constraints on circumbinary planet orbits from Kepler single transit events" (2015)
43. **Armstrong, D J**, EPSC2015-246 Conf. Proc., "Rotation, Activity, and Flaring of Kepler's Habitable Planet Hosts" (2015)
44. Brown, D J A, Anderson, D R, **Armstrong, D J** et al, arxiv:1412.7761, "Discovery of WASP-85Ab: a hot Jupiter in a visual binary system" (2014)
45. **Armstrong, D J** et al, arxiv:1411.6830, "K2 Variable Catalogue I: A Catalogue of Variable Stars from K2 Field 0" (2014)
46. **Armstrong, D J**, Martin, D V and Pollacco, D P, Proc. IAUS 299, 273, "Detecting Circumbinary Exoplanets: Understanding Transit Timing" (2014)
47. **Armstrong, D J**, Martin, D V, Pollacco, D P and Udry, S, EPSC2013-923 Conf. Proc., "Transit Timing Variations of Circumbinary Planets" (2013)
48. **Armstrong, D J** and Pollacco, D P, EPJ Web. Conf. 47, 2004, "Detecting circumbinary planets: A new quasi-periodic search algorithm" (2013)

Conference Presentations

ROPACS, Munich 2012, contributed talk
IAUS299, Victoria 2013, poster
NAM, St Andrews 2013, contributed talk
EPSC, London 2013, poster
UK Exoplanet meeting, Cambridge 2014, poster
UK Exoplanet meeting, Warwick 2015, contributed talk
EPSC, Nantes 2015, poster
NAM Llandudno 2015, poster
OHP 20 years of giant exoplanets, Marseilles 2015, poster
K2SciCon, Santa Barbara 2015, contributed talk
ESS3, Hawaii 2015, contributed talk
K2 Meeting, Porto 2016, contributed talk
NAM2016, Nottingham 2016, session organizer and chair
Exoplanets I, Davos 2016, poster
UK Exoplanet meeting, St Andrews 2017 – contributed talk
PLATO Science Conference, Warwick 2017 – contributed talk

Invited Talks and Seminars

Leicester University Seminar Series, June 2015 - invited seminar
ISSI Diversity of Planetary Systems, Bern, May 2016 – invited talk
Cambridge University Seminar Series, June 2016 – invited seminar
Rocks Rubble and Rings, Leiden, September 2016 – invited talk
TESS TASC WG0 1st meeting, Birmingham, October 2016 – invited workshop
ISSI Diversity of Planetary Systems, Bern, February 2017 – invited talk
TESS TASC WG0 2nd meeting, Aarhus, March 2017 – invited talk
UCLAN Seminar Series, May 2017 – invited seminar
PLATO Science Conference, Warwick, Sep 2017 – invited discussion lead