

# CURRICULUM VITAE

## DR. JAMES O'DONOGHUE

May 23, 2024

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### PERSONAL DETAILS

Name in full: Dr. James O'Donoghue, Research Associate Professor  
Nationality: British  
Institute: University of Reading, UK  
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### Expertise Keywords

Giant Planets; Jupiter; Saturn; Exoplanets; Upper-Atmosphere; Ionosphere; Magnetosphere, Rings. Astronomy; Spectroscopy; Coding; Science Communication; Animation and Teaching.

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**Data Acquisition** My career has advanced through my proposals and use of the world's premier telescopes, on which I have been awarded over 100 nights of observation time as a Principal Investigator and Co-Investigator on both ground- and space-based platforms. While my primary expertise lies in observing the giant planets Jupiter and Saturn, I have professionally studied every planet in the Solar System, the Moon, planetary satellites, exoplanets, stars, galaxies, and supernovae. My advanced coding experience in (mainly) IDL and Python, allows me to convert raw astronomical data into scientifically analysable form.

**Publication and Impact** I have published dozens of papers in multiple peer-reviewed journals as a first- and co-author, and am a co-author of two book chapters. These research outputs are often high impact (e.g. 3 first-author publications are in *Nature*) and receive much global press coverage, reflecting my strategy to prioritise the study of widely important physical processes.

**Professional Service** I served as a panelist for dozens of NASA grant proposals and the NASA Postdoctoral Program Fellowships. I have been (and continue to be) a reviewer for Hubble Space Telescope and James Webb Space Telescope proposals. I have peer-reviewed scientific literature for numerous journals and the Oxford Research Encyclopedia. I served as a co-convenor six times at conferences (2016-2024) and a judge in student poster awards.

**University teaching and Mentoring** For three years I taught practical lab-based classes, namely in how to make and use telescopes. I helped teach mathematical physics and was responsible for grading assignments. I co-mentored a masters student at Boston University (USA) and assisted in the work of an undergraduate research project at Tohoku University (Japan). I am an external supervisor to a Ph.D. student at University of Northumbria (UK).

**Science Communication** I make animated videos which are used by schools, planetariums, museums and universities worldwide and which received over 300 million views online and led to hundreds of news articles. I have been filmed for five documentary appearances to date, including with the state broadcaster of three countries: BBC, PBS (US), NHK (Japan). In person I have presented at Astronomy on Tap in Washington D.C., given public lectures at the Royal Astronomical Society and convened a session between the British Science Museum and the Japanese space agency. In 2021 I won the Europlanet Prize for Public Engagement with Science and in 2022 I was a finalist in the AAAS Early Career Award for Public Engagement with Science.

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## ACADEMIC BACKGROUND

**JAXA Institute of Space and Astronautical Science: Fellow** May 2019 - October 2023

**Research aims:** *Mapping Jupiter's ionospheric parameters, attempts to detect an exoplanetary ionosphere and continued monitoring of Saturn's rain*

**Summary:** My main research task was to produce global maps of Jupiter's ionospheric parameters (such as temperature). Maps have been produced for multiple days in multiple years and they appear to show that heat is redistributed away from the auroral region, which helps to explain the anomalously high temperatures measured planet-wide. Preliminary work was also done (estimates, proposals) to try to detect the ionosphere of an exoplanet for the first time, while at Saturn, the first attempts at trying to observe the electrically charged water product,  $\text{H}_3\text{O}^+$ , in Saturn's ionosphere for the first time.

**NASA Goddard Space Flight Center: Fellow** January 2017 - March 2019

**Research aims:** *Spacecraft-supporting observations of Jupiter & the effects of ring rain at Saturn*

**Summary:** In 2016, the Juno spacecraft entered orbit around Jupiter, and I performed supporting ground-based observations of Jupiter's infrared aurorae as Juno approached. We found that solar wind compressions of the Jovian magnetosphere led to auroral heating. I led a study which re-detected the signal of 'ring rain' - the flow of icy grains from rings to the planet - revealing also how it chemically and thermally affects the atmosphere. We estimated the decay rate and lifetime of Saturn's rings, approximately 300 hundred million years (<10% the solar system age).

**Boston University: Research Scientist** May 2014 - January 2017

**Research aims:** *Planet-wide investigations of Jupiter and Saturn's ionosphere*

**Summary:** The aim of this work was to provide insight into why global thermospheric temperatures are so high at gas giants. Saturn's auroral behaviour and ring-planet interactions were studied, as was Jupiter's low-latitude ionosphere. A major discovery from this work was that the Great Red Spot appears to heat the atmosphere 800 km above it, with the heating thought to be due to turbulence driving acoustic and gravity waves upwards from the storm itself. Saturn's auroral temperatures, densities and emissions were reported at high spatial and temporal resolution.

**University of Leicester: Planetary space science Ph.D.** October 2010 - May 2014

**Thesis:** *The response of gas giant ionospheres to their local space environments*

**Supervisor:** Dr. Tom Stallard

**Summary:** Telescopes were used to observe Saturn and Jupiter to take infrared spectral images in order to measure emission lines from the molecular ion  $\text{H}_3^+$ , which is present in the upper atmosphere. A major result from this work was the discovery that water entering the planet leaves an imprint on the upper atmosphere, this phenomenon is known as 'ring rain'. We also found that Saturn's northern spring-time aurorae are colder than the southern autumn aurorae.

**University of Wales, Aberystwyth** September 2006 - June 2010

**Planetary and Space Science B.Sc., First-class hon.**

**Dissertation:** *A Study of Lunar Impact Flashes*

**Supervisor:** Dr. Anthony Charles Cook

**Summary:** My dissertation project involved the use of two telescopes simultaneously to observe the shaded part of the lunar surface, looking for flashes of light known as 'impact flashes', which are due to meteoroids colliding with the moon.

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## INVITED TALKS: CONFERENCES AND SEMINARS

- 2024 Keynote speaker at a Department of Meteorology event at the University of Reading.
- 2024 Graduate Student Invited Seminar Speaker at Boston University (US)
- 2024 Talk given at the International Space Science Institute (ISSI) in Bern, Switzerland as part of a meeting on ‘Jupiter’s non-auroral Upper Atmosphere’.
- 2024 Seminar to Department of Meteorology at the University of Reading.
- 2023 Talk at Japan Geoscience Union (JpGU) on ‘Investigations of Giant Planet Upper Atmospheres: Past, Present and Future’.
- 2023 Talk for JAXA/ISAS Diversity Promotion team on ‘The Experience of Researching Internationally’.
- 2022 Seminar at JAXA/ISAS Coffee Talk on ‘A planetary-scale heat wave in Jupiter’s upper atmosphere’.
- 2022 Talk at the International Space Science Institute (ISSI) in Bern, Switzerland as part of an ‘ring-planet interactions’ meeting on ‘New and future observations of Saturn and insights for Jupiter, Uranus and Neptune’.
- 2021 Seminar at JAXA/ISAS Planetary Exploration Workshop on ‘Future Science at the Outer Planets’.
- 2021 Keynote Speaker for Outer Planet Systems at EuroPlanet Science Congress (EPSC) on ‘What the upper atmospheres of Giant Planets reveal’.
- 2021 Talk at EuroPlanet Science Congress (EPSC) on ‘Global upper-atmospheric heating at Jupiter by the recirculation of auroral energy’.
- 2021 Award-acceptance talk at EuroPlanet Science Congress (EPSC) for the Europlanet Prize for Public Engagement 2021.
- 2021 Talk at the Royal Astronomical Society’s Comparative equatorial Thermosphere-Ionosphere-Magnetosphere coupling meeting on ‘Observational evidence for upper-atmospheric heat transfer to Jovian equatorial latitudes from the auroral regions’.
- 2020 Seminar at Japan Science Communication Forum on ‘Animated Science Communication’.
- 2019 Seminar at Earth–Life Sciences Institute (Tokyo) on ‘Saturn’s Rings and Jupiter’s Great Red Spot: an animated discussion’.
- 2018 Seminar at Catholic University of America on ‘Revealing the inner-workings of Saturn’s Rings and Jupiter’s Great Red Spot with ionospheric measurements’.
- 2018 Talk at EuroPlanet Science Congress (EPSC) on ‘Ground-based observations of Giant Planet upper atmospheres’.

- 2017 Seminar at NASA Goddard Space Flight Center on ‘Heating of Jupiter’s upper atmosphere by the Great Red Spot’.
- 2016 Talk at the American Geophysical Union (AGU) conference on ‘Searching for sources of planet-wide heating in Jupiter’s upper atmosphere: new clues from the Great Red Spot’.
- 2016 Seminar at the University of New Hampshire on ‘Ground-based observations of Jupiter and Saturn: aurora, ring rain and Jupiter’s Great Red Spot’.
- 2015 Seminar at Georgia Institute of Technology on ‘Observations of gas giant ionospheres’.
- 2015 Talk at Magnetospheres of the outer planets (MOP) conference on ‘Ground-based observations of planetary aurorae’ in June.
- 2013 Talk given at the International Space Science Institute (ISSI) in Bern, Switzerland as part of a second ‘Comparative Jovian Aeronomy’ meeting on ‘Saturn’s ring rain’.
- 2012 Talk given at the International Space Science Institute (ISSI) in Bern, Switzerland as part of an ‘Comparative Jovian Aeronomy’ meeting on ‘Saturn’s auroral energy balance’.

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## GRANTS AWARDED

- 2023 Science and Technology Facilities Council Ernest Rutherford Fellowship over 5 years, \$850,000.
- 2022 Keck observatory award of \$14,000 as part of the award for Keck telescope time.
- 2021 Keck observatory award of \$12,750 as part of the award for Keck telescope time.
- 2020 Keck observatory award of \$12,750 as part of the award for Keck telescope time.
- 2019 JAXA International Top Young Fellowship, PI, grant of \$460,000.
- 2018 Keck observatory award of \$12,750 as part of the award for Keck telescope time.
- 2017 NASA grant NNN16ZDA001N-SSO: Solar System Observations, Science PI, \$395,969.
- 2017 NASA Postdoctoral Program Fellowship, PI, award of \$250,000 (not including overheads).
- 2017 Keck observatory award of \$11,000 as part of the award for Keck telescope time.
- 2016 Keck observatory award of \$15,000 as part of the award for Keck telescope time.
- 2014 NASA grant NNN13ZDA001N-PAST: Planetary Astronomy, main Co-I, \$351,052.
- 2012 Royal Astronomical Society (United Kingdom) travel grant of \$600.

Total: \$2,385,900

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## AWARDS/HONOURS

2022 Finalist for the American Association for the Advancement of Science (AAAS) Early Career Award for Public Engagement with Science.

2021 Winner of Europlanet Society Prize for Public Engagement with science.

2010 Elsie Pritchard Prize for achievement in physics.

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TELESCOPE TIME AWARDS

Year	Telescope	Nights	Role	Topic
2025	W.M. Keck	1.0	Co-I	Uranus: what drives the aurora with JWST
2025	W.M. Keck	0.5	Co-I	Jupiter: Juno spacecraft support
2024	W.M. Keck	1.5	PI	Saturn: Auroras and Ring Rain with JWST
2024	W.M. Keck	6.5	Co-I	Jupiter: Juno spacecraft support
2024	JWST Cyc 3	1.0	Co-I	Saturn: Hunting for the source of auroras, ID: 5308
2024	JWST Cyc 3	1.5	Co-I	Uranus: What drives the aurora? ID:5073
2023	JWST Cyc 2	1.9	Co-I	Jupiter: Unveiling the upper atmosphere, ID:3665
2022	JWST Cyc 1	2.6	Co-I	Giant planets: Early Release Science Obs., ID:1373
2023	NASA IRTF	3	Co-I	Jupiter: solving the energy crisis
2023	NASA IRTF	1	Co-I	Uranus: Energy drivers in the ionosphere
2022	W.M. Keck	1	Co-I	Uranus: mapping of the aurorae
2022	W.M. Keck	1	PI	Exoplanet: Attempt to detect aurora/ionosphere
2022	W.M. Keck	5	Co-I	Jupiter: supporting observations for Juno
2021	NASA IRTF	1.5	Co-I	Uranus: mapping of the aurorae
2021	W.M. Keck	1	PI	Saturn: Attempt to detect H <sub>3</sub> O <sup>+</sup>
2021	NASA IRTF	5.5	Co-I	Jupiter: Juno spacecraft support
2021	W.M. Keck	1	PI	Exoplanet: Attempt to detect aurora/ionosphere
2020	W.M. Keck	1	PI	Saturn: Search for ring rain
2020	NASA IRTF	2	PI	Exoplanet: Attempt to detect aurora/ionosphere
2020	NASA IRTF	9	Co-I	Saturn: Jupiter's magnetosphere at Saturn
2020	NASA IRTF	1	Co-I	Jupiter: Ganymede shadow observations
2019	NASA IRTF	1	Co-I	Saturn: Search for ring rain
2019	NASA IRTF	1.5	Co-I	Jupiter: Juno spacecraft support
2018	W.M. Keck	1.5	PI	Jupiter: Juno spacecraft support
2018	W.M. Keck	1.5	Co-I	Jupiter: Juno spacecraft support
2018	NASA IRTF	3	PI	Jupiter: Juno spacecraft support
2017	W.M. Keck	1.5	PI	Jupiter: Juno spacecraft support
2017	NASA IRTF	4	Co-I	Jupiter: Juno spacecraft support
2017	NASA IRTF	1	PI	Jupiter: Juno spacecraft support
2017	W.M. Keck	1	Co-I	Jupiter: Juno spacecraft support
2016	W.M. Keck	1.5	Co-I	Saturn: Cassini spacecraft support
2016	W.M. Keck	2	PI	Jupiter: Juno spacecraft support
2016	NASA IRTF	1	PI	Mars: Searching for H <sub>3</sub> <sup>+</sup>
2016	NASA IRTF	2	Co-I	Jupiter: Juno spacecraft support
2015	Gemini N.	3	Co-I	Saturn: Influence of the Sun on polar ionosphere
2015	NASA IRTF	2	Co-I	Uranus: Energy drivers in the ionosphere
2015	NASA IRTF	1	Co-I	Titan: Searching for H <sub>3</sub> <sup>+</sup>
2015	NASA IRTF	6	PI	Jupiter: Low-latitude heating
2015	NASA IRTF	2	Co-I	Jupiter: Ionospheric velocities
2015	NASA IRTF	3.5	Co-I	Saturn: Solar wind effects on the polar ionosphere
2014	W.M. Keck	2	Co-I	Saturn: Cassini spacecraft support
2014	Gemini N.	4	Co-I	Saturn: Energy flows in the auroral region
2014	NASA IRTF	3.5	Co-I	Jupiter: Hisaki (EXCEED) spacecraft support
2014	W.M. Keck	2	Co-I	Saturn: Auroral and equatorial mapping

2014	NASA IRTF	13	Co-I	Saturn: Cassini spacecraft support
2013	W.M. Keck	4	Co-I	Saturn: Cassini spacecraft support
2013	Gemini N.	2	Co-I	Uranus: Energy drivers of the upper atmosphere
2013	NASA IRTF	2	Co-I	Jupiter: Hisaki (EXCEED) spacecraft support
2013	NASA IRTF	6.5	Co-I	Saturn: Cassini spacecraft support
2012	NASA IRTF	5.5	PI	Jupiter: global ionosphere mapping
2011	NASA IRTF	18	Co-I	Jupiter, Saturn & Uranus: various topics
Total:		151.9 nights		

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## SCIENCE COMMUNICATION, OUTREACH AND NEWS MEDIA

I have produced 75 original space-themed animations for use in explaining complicated space science and physics concepts. These videos have received 300 million views across the web (Twitter, Youtube, Reddit, Instagram, LinkedIn, etc.), generating hundreds of news articles. This animated outreach has been used at every level of education, from elementary schools to Ivy League universities (e.g. Stanford University), as well as by planetariums and museums (e.g. Smithsonian Air and Space Museum). All videos were released via my Twitter account @physicsJ and Youtube channel, which have a combined ~250,000 people following and subscribing. Famed astrophysicist and communicator Dr. Neil deGrasse Tyson remarked on these efforts in 2021 on Twitter: “This is pedagogically brilliant, James O’Donoghue, and so the rest of your Twitter stream”. These efforts were recognised by international science organisations: in 2021 I was awarded the Europlanet Society Prize for Public Engagement and in 2022 was a selected finalist for the American Association for the Advancement of Science (AAAS) Early Career award for Public Engagement with Science. Outreach highlights are listed below.

- 2024 Documentary appearance for BBC’s Solar System, with Prof. Brian Cox, episode 5 “Strange Worlds”.
- 2024 Documentary appearance, on location in the Canary Islands, for Public Broadcasting Service (PBS) NOVA in the USA on “Strange Worlds”.
- 2024 Led NASA International Observe The Moon Night at University of Reading, audience 200 looking through telescopes, 1,100 online.
- 2024 Two public lectures delivered at the Royal Astronomical Society at Burlington House, London.
- 2023 Consultant and Featured Expert for the Space chapter of Britannica’s Encyclopedia Infographica.
- 2023 Animation featured in documentary ‘Cosmic Front’ by Japanese national broadcaster NHK.
- 2022 Animation featured in ‘Are you smarter than a 5th grader’, Japan edition.
- 2022 Created fly-by animations for the BepiColombo mission, which flew by Mercury in June 2022.
- 2022 Organiser for a global outreach event ‘Observe the Moon night’, acting as a bridge between JAXA and NASA.
- 2022 Chaired the live event ‘Hayabusa2 and beyond’ on behalf of JAXA at the British Science Museum.
- 2021 Organiser for a global outreach event ‘Observe the Moon night’, acting as a bridge between JAXA and NASA.
- 2021 Created fly-by animations for the BepiColombo mission, which flew by Venus in August 2021.
- 2021 Co-hosted a live Uranus-observing event with the Royal Astronomical Society.



- 2021 Co-organised a public outreach broadcast for an open day at the JAXA Institute of Space and Astronautical Science.
- 2020 Seminar at American School in Japan on ‘An animated tour of the solar system’.
- 2019 Hosted an exhibit (using animations) during a public open day at JAXA Institute of Space and Astronautical Science.
- 2019 Featured in an episode on the Discovery Channel documentary ‘Strip the Cosmos’ for an episode about Saturn’s ‘Ring Rain’.
- 2018 Featured in an episode of the Science Channel documentary ‘Space’s Deepest Secrets’. Season 5, episode 3, title ‘Journey to Saturn’s Rings’.
- 2017 Interviewed by the New York Times and Boston Globe about the historic event in which the Juno spacecraft took the closest images of the Great Red Spot.
- 2017 Documentary film crew interview for Japanese television company NHK ‘Cosmic Front’, which aired March 2017. The episode discussed Jupiter’s the Great Red Spot, and in the interview I answer questions about Publication 6 while observing using the Keck telescope.
- 2016 Large press release after Publication 12 appeared in *Nature* which detailed heating of Jupiter’s atmosphere above the Great Red Spot. This was featured in over 130 news outlets, please see the full list and metrics at <https://nature.altmetric.com/details/10073122>.
- 2014 Volunteer for ‘Stargazing Live’, a BBC production in which several cities involve the public in amateur/professional astronomy. In particular, I presented a poster to the public about Jupiter and Saturn and answered their questions.
- 2014 Invited public talk given at Stratford upon Avon Astronomical Society in January on ‘Saturn’s Ring Rain’.
- 2014 Took part in ‘Live at the Observatory’ where we answered questions from the general public whilst taking observations of Saturn. This took place at the Keck telescope in Hawai’i and we had an audience of ~1,000 throughout the night.
- 2013 Invited radio appearance on BBC Radio Leicester as part of a panel of experts: my specialty was ‘space’ and the other panelists were a comedian and a funeral director.
- 2013 Large press release on Publication 4 (my first lead-author publication). This appeared in *Nature* and detailed our discovery that Saturn is rained upon by its ring system. After numerous interviews, press releases appeared in *New Scientist*, *The New York Times*, *The Los Angeles Times*, *Hawai’i Tribune Herald* (front page) and a *BBC Leicester* radio interview.
- 2012 At the NASA infrared telescope facility (IRTF) we had live outreach to high schools and universities in which we explained our work to the interested public.

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PEER REVIEWED JOURNAL PUBLICATIONS

36. **J. O'Donoghue**, L. Moore, T. Stallard, B. Kurth, et al. A potential planetary-scale auroral heat transport event observed at Jupiter following a solar-wind compression. *Geophys. Res. Lett.*, submission Nov 2024.
35. Melin, H., **O'Donoghue, J.**, Moore, L., et al. Ionospheric irregularities at Jupiter observed by JWST. *Nat. Astron.* 8, 1000–1007, doi:10.1038/s41550-024-02305-9, 2024.
34. Agiwal, O., Cao, H., Hsu, H-W., Moore, L., .. O'Donoghue, J. [6], et al. Current Events at Saturn: Ring–Planet Electromagnetic Coupling. *Planet. Sci. J.* 5, 134, doi:10.3847/PSJ/ad4343, 2024.
33. Bockelee-Morvan, D., Lellouch, E., Poch, O., Quirico, E., .. O'Donoghue, J. [7], et al. Composition and thermal properties of Ganymede's surface from JWST/NIRSpec and MIRI observations. *Astronomy & Astrophysics* 681, p. A27, doi:10.1051/0004-6361/202347326, 2024.
32. Cao, X., Chu, X., Hsu, H-W., Cao, H., .. O'Donoghue, J. [6], et al. Science return of probing magnetospheric systems of ice giants. *Front. Astron. Space Sci.* 11:1203705. doi:10.3389/fspas.2024.1203705, 2024.
31. Wang, R., Stallard, T. S., Melin, H., Baines, K. H., .. O'Donoghue, J. [6], et al. Asymmetric ionospheric jets in Jupiter's aurora. *J. Geophys. Res. Space Phys.* 128, 12, doi:10.1029/2023JA031861, 2023.
30. **J. O'Donoghue**, Stallard, T., What the Upper Atmospheres of Giant Planets Reveal. *Remote Sensing*, 14, 6326, doi:10.3390/rs14246326, 2022.
29. Chowdhury, M. N., Stallard, T. S., Baines, K. H., Provan, G., .. O'Donoghue, J. [6], et al. Saturn's weather-driven aurorae modulate oscillations in the magnetic field and radio emissions. *Geophys. Res. Lett.*, doi:10.1029/2021GL096492, 2022.
28. **O'Donoghue, J.**, Moore, L., Melin, H., Stallard, T. S., et al. Global upper-atmospheric heating on Jupiter by the polar aurorae. *Nature*, doi:10.1038/s41586-021-03706-w, 2021.
27. Moore, L., Moses, J. I., Melin, H., Stallard, T. S., .. O'Donoghue, J. [5], et al. Atmospheric implications of the lack of  $\text{H}_3^+$  detection at Neptune. *Phil. Trans. R. Soc. A.* 37820200100, doi:10.1098/rsta.2020.0100, 2020.
26. Yurchenko, S. N., Tennyson, J., Miller, S., Melnikov, V. V., .. O'Donoghue, J. [5], et al. ExoMol line lists – XL. Rovibrational molecular line list for the hydronium ion ( $\text{H}_3\text{O}^+$ ). *Monthly Notices of the Royal Astronomical Society*, 497(2), Pages 2340-2351, doi:10.1093/mnras/staa2034, 2020.
25. **O'Donoghue, J.**, Moore, L., Connerney, J. E. P., Melin, H., et al. Observations of the chemical and thermal response of 'ring rain' on Saturn's ionosphere. *Icarus*, 322, Pages 251-260, doi:10.1016/j.icarus.2018.10.027, 2019.
24. Moore, L., Melin, H., **O'Donoghue, J.** [5], et al. Modelling  $\text{H}_3^+$  in planetary atmospheres: effects of vertical gradients. *Phil. Trans. R. Soc. A.* 377, 20190067, doi:10.1098/rsta.2019.0067, 2019.

23. Ray, L. C., Lorch, C. T. S., .. O'Donoghue, J. [5], et al. Why is the  $\text{H}_3^+$  hot spot above Jupiter's Great Red Spot so hot? *Phil. Trans. R. Soc. A* 377, 20180407, doi:10.1098/rsta.2018.0407, 2019.
22. Melin, H., Fletcher, L. N., Stallard, T. S., .. O'Donoghue, J. [5], et al. The  $\text{H}_3^+$  ionosphere of Uranus: decades-long cooling and local-time morphology. *Phil. Trans. A*, doi:10.1098/rsta.2018.0408, 2019.
21. Stallard, T., Baines, K., Melin, H., Bradley, T., .. O'Donoghue, J. [6], et al. Local-time averaged maps of  $\text{H}_3^+$  emission, temperature and ion winds. *Phil. Trans. A*, doi:10.1098/rsta.2018.0405, 2019.
20. Moore, L., Galand, M., Kliore, A., Nagy, A., .. O'Donoghue, J. [5], et al. Saturn's ionosphere: ring rain and other drivers. *In book chapter: Saturn in the 21st Century*, Cambridge University Press, doi:10.1017/9781316227220, 2018.
19. Hsu, H. W., Schmidt, J., Kempf, S., Postberg, F., Moragas-Klostermeyer, G., Seiß, M., Hoffmann, H., Burton, M., Ye, S., Kurth, W. S., Horanyi, M., Khawaja, N., Spahn, F., Schirdewahn, D., **O'Donoghue, J.** [7], Moore, L., Cuzzi, J., Jones, G. H., Srama, R. In situ collection of dust grains falling from Saturn's rings into its atmosphere. *Science*, 362 (6410), 2018.
18. Stallard, T., Burrell, A. G., Melin, H., Fletcher, L. N., Miller, S., Moore, L., **O'Donoghue, J.** [6], et al. Identification of Jupiter's magnetic equator through  $\text{H}_3^+$  ionospheric emission. *Nat. Astron.*, 2(7), doi:10.1038/s41550-018-0523-z, 2018.
17. Melin, H., Fletcher, L. N., Stallard, T. S., Johnson, R. E., **O'Donoghue, J.** [5], Moore, L., Donnelly, P. T. The quest for  $\text{H}_3^+$  at Neptune: deep burn observations with NASA IRTF iSHELL. *Monthly Notices of the Royal Astronomical Society*, 474(3), Pages 3714-3719, doi:10.1093/mnras/stx3029, 2018.
16. **O'Donoghue, J.**, Moore, L., Connerney, J. E. P., Melin, H., et al. Re-detection of the ionospheric  $\text{H}_3^+$  signature of Saturn's "ring rain". *Geophys. Res. Lett.*, 44(11), Pages 11762-11769, doi:10.1002/2017GL075932, 2017.
15. Stallard, T., Melin, H., Miller, S., **O'Donoghue, J.** [6], et al. Great Cold Spot in Jupiter's upper atmosphere. *Geophys. Res. Lett.*, 44(7), Pages 3000-3008, doi:10.1002/2016GL071956, 2017.
14. Moore, L., **O'Donoghue, J.**, Melin, H., Stallard, T., et al. Variability of Jupiter's IR  $\text{H}_3^+$  aurorae during Juno approach. *Geophys. Res. Lett.*, 44, Pages 4513-4522, doi:10.1002/2017GL073156, 2017.
13. **O'Donoghue, J.**, Moore, L., Stallard, T. S., Melin, H., et al. Heating of Jupiter's upper atmosphere above the Great Red Spot. *Nature*, 536(7615), Pages 190-192, doi:10.1038/nature18940, 2016.
12. Stallard, T., Clarke, J. T., Melin, H., Miller, S., Nichols, J. D., **O'Donoghue, J.** [6], et al. Stability within Jupiter's polar auroral 'Swirl region' over moderate timescales. *Icarus*, 268, 145-155, doi:10.1016/j.icarus.2015.12.044, 2016.

11. **O'Donoghue, J.**, Melin, H., Stallard, T. S., Provan, G., Moore, L., Badman, S. V., Cowley, S. W. H., Baines, K. H., Miller, S., Blake, J. S. D. Ground-based observations of Saturn's auroral ionosphere over three days: trends in  $H_3^+$  temperature, density and emission with Saturn local time and planetary period oscillation. *Icarus*, 263, 44-55, doi:10.1016/j.icarus.2015.04.018, 2016.
10. Melin, H., Badman, S. V., Stallard, T. S., Cowley, S. W. H., Dyudina, U., Nichols, J. D., Provan, G., **O'Donoghue, J.** [7], Pryor, W. R., Baines, K. H., Miller, S., Gustin, J., Radioti, A., Tao, C., Meredith, C. J., Blake, J. S. D., Johnson, R. E. Simultaneous multi-scale and multi-instrument observations of Saturn's aurorae during the 2013 observing campaign. *Icarus*, 263, 56-74, doi:10.1016/j.icarus.2015.08.021, 2016.
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