Saburo Howard | **Curriculum Vitae**

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Education and research experience

Nov 2023 – present **Postdoctoral researcher**. Institut für Astrophysik, Universität Zürich, Switzerland. Supervisor: Ravit Helled

Oct 2020 – 2023 **PhD student**. Université Côte d'Azur, Institut Lagrange, Nice, France Supervisor: Tristan Guillot

2019 – 2020 **Master in Astrophysics**, Université de Strasbourg, France

2018 – 2019 **Mechanical engineer**, Dassault Aviation, Saint-Cloud, France

2015 – 2018 **ISAE-ENSMA**, École Nationale Supérieure de Mécanique et d'Aérotechnique, Poitiers

2013 – 2015 **PCSI/PC** – Classes Préparatoires aux Grandes Écoles, Lycée Saint-Louis, Paris

Teaching experience

2025 – present **Teaching assistant**, Universität Zürich
Led exercise classes for the course "The Sun and Planets", targeting 1st- to 3rd-year undergraduate students.

2025 Lecture about planetary interiors at an **ARIEL summer school** (*https://www.ariel-mission.fr/ares-iv-2025/*)

2021 – 2023 **Teaching assistant**, Université Côte d'Azur
Conducted exercise classes in Optics and supervised laboratory sessions in Thermodynamics and Waves, for 1st- and 2nd-year undergraduate students.

Supervision of students

2024 – 2025 Lorenzo Peerani – 2nd-year master student, UZH, Zürich (6 months)

2024 Niels Faucher – 1st-year master student, Université de Besançon (3 months)
Jonas Schlör – 1st-year master student, ETH, Zürich (6 months)

Community tasks

Since 2024 Organizor of the « Astrophysics seminars », Universität Zürich (*https://www.astro.uzh.ch/en/Information---Events/seminars.html*)

2021 – 2023 Representative of the PhD students at the lab Council, Institut Lagrange, Nice

Since 2022 Referee for *Monthly Notices of the Royal Astronomical Society*, *Astronomy & Astrophysics*, *Icarus* and *Nature Communications*

Involvement in international collaborations

Since 2023 Member of the NCCR **PlanetS** consortium.

Since 2020 Member of the Interior Working Group (IWG) of the **Juno** mission. Involved in the regular meetings of the prime (2016-2021) and extended (2021-2025) missions. Involved in the writing of the proposal to NASA for the extended-extended mission.

Since 2020 Member of the **PLATO** Work Package « Gas & Ice Giant Composition ».

Contribution to the community

Equation of state table for interactions between hydrogen and helium
(available at *https://zenodo.org/records/7346181*)

Close collaborators

T. Guillot (Institut Lagrange, Nice), R. Helled, S. Müller, G. Mazzola (University of Zurich), Y. Miguel, V. Ramirez (University of Leiden), M. Bazot (University of Heidelberg), N. Nettelmann, R. Redmer, A. Bergermann (University of Rostock), D. J. Stevenson (Caltech, USA), W. B. Hubbard (LPL, Arizona), S. Markham (New Mexico State University), E. Galanti, Y. Kaspi, M. Ziv (Weizmann Institute, Israel)

References

Dr. Tristan Guillot
Institut Lagrange, Observatoire de la Côte d'Azur
tristan.guillot@oca.eu

Pr. Ravit Helled
Institut für Astrophysik, Universität Zürich, Switzerland
ravit.helled@uzh.ch

Saburo Howard | **Publications and conferences**

Publications

- 5 **first author** (« corresponding author ») publications:

1. **Howard S.**, Helled R., Müller S., *Astronomy & Astrophysics*, 2025
   Giant exoplanet composition: The impact of the hydrogen-helium equation of state and interior structure
2. **Howard S.**, Müller S., Helled R., *Astronomy & Astrophysics*, 2024
   Evolution of Jupiter and Saturn with helium rain
3. **Howard S.**, Guillot T., Markham S., Helled R., Müller S., *et al.*, *Astronomy & Astrophysics*, 2023
   Exploring the hypothesis of an inverted Z gradient inside Jupiter
4. **Howard S.**, Guillot T., Bazot M., Miguel Y., Stevenson D.J., *et al.*, *Astronomy & Astrophysics*, 2023
   Jupiter's interior from Juno: equation of state uncertainties and dilute core extent
5. **Howard S.** & Guillot T., *Astronomy & Astrophysics*, 2023
   Accounting for non-ideal mixing effects in the hydrogen-helium equation of state

- 11 **co-author** publications:

6. Ziv M., Galanti E., **Howard S.**, Guillot T., Kaspi Y., *et al.*, *Astronomy & Astrophysics*, 2024
   Characterizing Jupiter's interior using machine learning reveals four key structures
7. Ziv M., Galanti E., Sheffer A., **Howard S.**, Guillot T., *et al.*, *Astronomy & Astrophysics*, 2024
   NeuralCMS: A deep learning approach to study Jupiter's interior
8. Schmider F. X., et al. (**Howard S.**), *The Planetary Science Journal*, 2024
   Three-dimensional Atmospheric Dynamics of Jupiter from Ground-based Doppler Imaging Spectroscopy in the Visible
9. Hobson M., *et al.* (**Howard S.**), *The Astronomical Journal*, 2023
   TOI-199b: A well-characterized 100 day transiting warm giant planet with TTVs seen from Antarctica
10. Sha L., *et al.* (**Howard S.**), *Monthly Notices of the Royal Astronomical Society*, 2023
    TESS spots a mini-neptune interior to a hot saturn in the TOI-2000 system
11. Bloot S., Miguel Y., Bazot M., **Howard S.**, *Monthly Notices of the Royal Astronomical Society*, 2023
    Exoplanet interior retrievals: core masses and metallicities from atmospheric abundances
12. Korth J., Gandolfi D., Subjak J., **Howard S.**, *et al.*, *Astronomy & Astrophysics*, 2023
    TOI-1130: A photodynamical analysis of a hot Jupiter in resonance with an inner low-mass planet
13. Psaridi A., *et al.* (**Howard S.**), *Astronomy & Astrophysics*, 2023
    Three Saturn-mass planets transiting F-type stars revealed with TESS and HARPS. TOI-615b, TOI-622b, and TOI-2641b
14. Vowell N., *et al.* (**Howard S.**), *The Astronomical Journal*, 2023
    HIP 33609b: An eccentric brown dwarf transiting a V = 7.3 rapidly rotating B star
15. Trifonov T., *et al.* (**Howard S.**), *The Astronomical Journal*, 2022
    TOI-2525b and c: A pair of massive warm giant planets with strong transit timing variations revealed by TESS
16. Miguel Y., Bazot M., Guillot T., **Howard S.**, *et al.*, *Astronomy & Astrophysics*, 2022
    Jupiter's inhomogeneous envelope

- Review chapters :

17. Helled R. & **Howard S.**, Chapter for the '*Encyclopedia of Astrophysics*' to be published by Elsevier
Giant planet interiors and atmospheres
18. Guillot T. & **Howard S.**, Article for the '*Encyclopedia Universalis*' (French encyclopedia) about the results of the Juno mission.
Juno

- Submitted papers:

19. **Howard S.**, Helled R., Bergermann A., Redmer R, (submitted to *Astronomy & Astrophysics*)
The Possibility of Hydrogen-Water Demixing in Uranus, Neptune, K2-18b and TOI-270d
20. Ramirez V., Miguel Y., **Howard S.**, (submitted to *Nature Astronomy*, in review)
A paradigm shift in planetary composition: Evidence for a rock-dominated envelope in Neptune
21. Xie H., **Howard S.**, Mazzola G., (submitted to *Physical Review Letters*, in review)
Accurate and thermodynamically consistent hydrogen equation of state for planetary modeling with flow matching
22. Cozza C., Nakano K., **Howard S.**, Xie H., Helled R., Mazzola G., (submitted to *Physical Review X*, in review)
Quantum Monte Carlo benchmarked hydrogen equation of state at planetary conditions

- PhD thesis:

Intérieurs des planètes géantes : de Juno à Plato

Conferences

Sept 2024	EPSC (European Planetary Science Congress), Berlin, Germany Evolution of Jupiter and Saturn with helium rain (*talk*)
June 2024	Exoplanets 5, Leiden, The Netherlands Interior of Jupiter and new equations of state: what consequences for exoplanets? (*poster*)
Dec 2023	AGU (American Geophysical Union), San Francisco, USA From Jupiter to giant exoplanets: the importance of equations of state and high-pressure modelling (***invited** talk*)
Sept 2023	HP4 (High Pressure, Planetary and Plasma Physics), Rostock, Germany Jupiter's interior: the importance of equations of state (***invited** talk*)
March 2023	Planet-ESLAB, Noordwijk, The Netherlands Interior of Jupiter and new equations of state: what consequences for exoplanets? (*talk*)
Jan 2023	Exosystèmes III, Marseille, France Interior of Jupiter and new equations of state: what consequences for exoplanets? (*talk*)
Dec 2022	AGU (American Geophysical Union), Chicago, USA How extended is Jupiter's dilute core? (*talk*)
July 2022	COSPAR, Athenes, Greece Robustness of Jupiter interior model solutions: importance of the hydrogen-helium equation of state (*talk*)

Dec 2021	Exosystèmes II, Toulouse, France Jupiter's interior and the consequences on exoplanets (*talk*)
Oct 2021	DPS (Division of Planetary Science), online Exploration of the structure of giant planets with fast calculations and a Bayesian approach (*talk*)
Sept 2021	EPSC (European Planetary Science Congress), online Exploration of the structure of giant planets with fast calculations and a Bayesian approach (*talk*)

Seminars and workshops

Nov 2025	Workshop on « Planet formation from the Atmosphere-Interior Perspective », Tel Aviv, Israel **Invited** by Allona Vazan
Oct 2025	ISSI workshop on « Unsolved mysteries of the Uranian system », Bern, Switzerland **Invited** by Ian Cohen
July 2025	Visit at Caltech, Pasadena, USA **Invited** by Dave Stevenson
July 2025	Seminar at JPL (Jet Propulsion Laboratory), Pasadena, USA **Invited** by Yasuhiro Hasegawa
June 2025	SF2A (Société Française d'Astronomie et d'Astrophysique), Toulouse, France
Dec 2024	Visit at IAS (Institut d'Astrophysique Spatiale), Saclay **Invited** by Mathieu Vincendon
Oct 2024	PLATO workshop, Observatoire de la Côte d'Azur, Nice, France **Invited** by Tristan Guillot
May 2024	Seminar at the University of Zurich, Switzerland
April 2024	General Assembly of the PlanetS consortium, Engelberg, Switzerland
July 2023	Juno science team meeting, Rome, Italy
May 2023	Seminar at the Weizmann Institute, Rehovot, Israel **Invited** by Eli Galanti and Yohai Kaspi
April 2023	Seminar at the University of Zurich, Switzerland **Invited** by Ravit Helled
Dec 2022	Seminar at the University of Michigan, Ann Arbor, USA **Invited** by Cheng Li
June 2022	Juno science team meeting on the prime mission, Pasadena, USA
June 2022	SF2A (Société Française d'Astronomie et d'Astrophysique), Besançon, France