

Sukrit Ranjan

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Education

Harvard University **PhD, Astronomy & Astrophysics** **May 2017**
PhD Thesis: "The UV Environment For Prebiotic Chemistry". Research Exam (MA Thesis): "Characterization of 5 Hot Jupiter Atmospheres with WFC3 On HST". Certificate in Origin of Life studies.

M.I.T. **SB, Physics** **June 2010**
Major in Physics, minors in History and Astronomy. Elected to ΦBK and ΣΠΣ. GPA 4.93/5.00.

Professional Appointments

Northwestern University **CIERA Postdoctoral Fellow** **09/2020-Present**
Center for Interdisciplinary Exploration and Research in Astrophysics (CIERA) prize postdoctoral fellow at Northwestern University. Leading research program focused on understanding the origin of life on Earth, rocky planet atmospheres and their potential biosignatures, and improvement of photochemical models through measurements and model intercomparisons.

M.I.T. **SCOL Postdoctoral Fellow** **09/2017-08/2020**
Simons Collaboration on the Origin of Life (SCOL) prize postdoctoral fellow at MIT. Leading research program focused on understanding the origin of life on Earth and remotely detectable biosignatures on exoplanets, with particular emphasis on photochemistry.

Other Appointments

- **Blue Marble Space Institute of Science**, Affiliate Research Scientist. 06/20-present
 - **Indian Institute of Astrophysics**, Postdoctoral Researcher. PI: Sujan Sengupta. 06-08/2017.
 - **NASA Ames Research Center**, Research Associate (NASA Academy leadership training program). PI: Nathalie Cabrol. 06-08/2010.
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Fellowships & Grants

- **HST Guest Observer Program**, "Chromospheric and Coronal Activity in the Lowest-Mass Stars", Co-I, 2020, 33 orbits/~ \$224k.
 - **CIERA Postdoctoral Fellowship**, 2020-2023
 - **SCOL Postdoctoral Fellowship**, 2017-2020
 - **NSF Graduate Research Fellowship**, 2010-2013
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Awards and Honors

- **NAI Early Career Scholarship**, 2018.
 - **AAS Rodger Doxsey Prize**, 2017.
 - **Harvard Astronomy Department Outstanding Mentor Certificate**, 2014 & 2015.
 - **NAI Scholarship (International Summer School In Astrobiology)**, 2014
 - **AGU Fall Meeting Outstanding Student Paper Award**, 2013.
 - **Harvard University Certificate of Distinction in Teaching**, 2012.
 - **NAI Scholarship (Nordic-NASA Summer School)** 2012.
 - **MIT Joel Matthew Orloff Award for Outstanding Service in Physics**, 2010.
 - **NASA Ambassador for International Year of Astronomy**, 2009.
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Peer-Reviewed Publications (Published or Submitted)

* = mentored or co-mentored student

First-Author Publications

10. **Ranjan, S.**, S. Seager, Z. Zhan, D. Koll, W. Bains, J. Petkowski, J. Huang, Z. Lin, 2021. Photochemical Runaway in Exoplanet Atmospheres: Implications for Biosignatures. *Nature Astronomy*, *in review*.
9. **Ranjan, S.**, C. Kufner, G. Lozano, Z. Todd, A. Haseki*, D. Sasselov, 2020. UV Transmission in Natural Waters on Prebiotic Earth: Halide and Ferrous Species. *Astrobiology*, *in review*.
8. **Ranjan, S.**, E. Schwieterman, C. Harman, A. Fateev, C. Sousa-Silva, S. Seager, R. Hu, 2020. Photochemistry of Anoxic Abiotic Habitable Planet Atmospheres: Impact of New H₂O Cross-Sections. *The Astrophysical Journal*, 896, 2.
7. **Ranjan, S.**, Z. Todd, P. Rimmer, D. Sasselov, A. Babbin, 2019. Nitrogen Oxide Concentrations in Natural Waters on Early Earth. *Geochemistry, Geophysics, Geosystems*, 20, 2021.
6. **Ranjan, S.**, Z. Todd, J. Sutherland, and D. Sasselov, 2018. Sulfidic Anion Concentrations on Early Earth for Surficial Origins-of-Life Chemistry. *Astrobiology*, 18, 1023.
5. **Ranjan, S.**, R. Wordsworth, and D. Sasselov, 2017b. The Surface UV Environment on Planets Orbiting M-Dwarfs: Implications for Prebiotic Chemistry & Need for Experimental Follow-Up. *The Astrophysical Journal*, 843, 110.
4. **Ranjan, S.**, R. Wordsworth, and D. Sasselov, 2017a. Atmospheric Constraints on the Surface UV Environment of Mars at 3.9 Ga Relevant to Prebiotic Chemistry. *Astrobiology*, 17, 687.
3. **Ranjan, S.** and D. Sasselov, 2017. Constraints on the Early Terrestrial Surface UV Environment Relevant to Prebiotic Chemistry. *Astrobiology*, 17, 169.
2. **Ranjan, S.** and D. Sasselov, 2016. Influence of UV Radiation on the Synthesis of Prebiotic Molecules. *Astrobiology*, 16, 68.
1. **Ranjan, S.**, D. Charbonneau, J.-M. Désert, N. Madhusudhan, L. D. Deming, A. N. Wilkins, and A. M. Mandell, 2014. Atmospheric Characterization of 5 Hot Jupiters with the Wide Field Camera 3 on the Hubble Space Telescope. *The Astrophysical Journal*, 785, 148.

Co-Author Publications

17. An, S., **S. Ranjan**, K. Yuan, X. Yang, R. Skodje, 2021. The Role of the Three Body Photodissociation Channel of Water in the Evolution of Dioxygen in Astrophysical Applications. *Physical Chemistry Chemical Physics*, *accepted*.
16. Greaves, J., W. Bains, J. Petkowski, S. Seager, C. Sousa-Silva, **S. Ranjan**, D. Clements, P. Rimmer, H. Fraser, S. Mairs, M. Currie, 2020. On the Robustness of Phosphine Signatures in Venus' Clouds. *Nature Astronomy Matters Arising*, *in review*. arXiv:2012.05844
15. Rimmer, P., **S. Ranjan**, S. Rugheimer, 2020. Starting and Searching for Life on Rocky Planets. *Life*, *accepted*.
14. Bains, W., J. Petkowski, S. Seager, **S. Ranjan**, et al., 2020. Phosphine on Venus Cannot be Explained by Conventional Processes. *Astrobiology*, *in review*. arXiv:2009.06499
13. Huang, J.*, S. Seager, J. Petkowski, **S. Ranjan**, Z. Zhan, 2020. Reassessment of Ammonia as a Biosignature Gas in Exoplanet Atmospheres. *Astrobiology*, *in review*.
12. Zhan, Z., S. Seager, J. Petkowski, C. Sousa-Silva, **S. Ranjan**, et. al., 2020. Assessment of Isoprene as a Possible Biosignature Gas in Exoplanets with Anoxic Atmospheres. *Astrobiology*, *accepted*. arXiv:2103.14228
11. Greaves, J., A. Richards, W. Bains, P. Rimmer, H. Sagawa, D. Clements, S. Seager, J. Petkowski, C. Sousa-Silva, **S. Ranjan**, et al., 2020. Phosphine Gas in the Cloud Decks of Venus. *Nature Astronomy*, <https://doi.org/10.1038/s41550-020-1174-4>.
10. Seager, S., J. Petkowski, P. Gao, W. Bains, N. Bryan, **S. Ranjan**, J. Greaves, 2020. The Venusian Lower Atmosphere as a Depot for Desiccated Microbial Life: A Proposed Life Cycle for Persistence of the Venusian Aerial Biosphere. *Astrobiology*, *in press*.
9. Todd, Z, A. Fahrenbach, **S. Ranjan**, C. Magnani, J. Szostak, D. Sasselov, 2020. UV-driven deamination of cytidine ribonucleotides under planetary conditions. *Astrobiology*, 20, 878-888.
8. Guenther, M., Z. Zhan, S. Seager, P. Rimmer, **S. Ranjan**, et. al., 2020. Stellar Flares from the First TESS Data Release: Exploring a New Sample of M Dwarfs. *The Astronomical Journal*, 159, 2.

7. Sousa-Silva, C., S. Seager, **S. Ranjan**, J. J. Petkowski, Z. Zhan, R. Hu, W. Bains, 2020. On Phosphine as a Biosignature Gas in Exoplanet Atmospheres. *Astrobiology*, 20, 235.
6. Xu, J., D. Ritson, **S. Ranjan**, Z. Todd, D. Sasselov, J. Sutherland, 2018. Photochemical reductive homologation of hydrogen cyanide using sulfite and ferrocyanide. *Chemical Communications*, 54, 5566.
5. Todd, Z.*, A. Fahrenbach, C. Magnani*, **S. Ranjan**, A. Bjorkborn, J. Szostak, D. Sasselov, 2018. Solvated-electron production using cyanocuprates is compatible with the UV-environment on a Hadean-Archaeon Earth. *Chemical Communications*, 54, 1121.
4. Wilkins, A. N., L. D. Deming, N. Madhusudhan, A. Burrows, H. A. Knutson, P. McCullough, and **S. Ranjan**, 2014. The Emergent 1.1-1.7 μm Spectrum of the Exoplanet CoRoT-2b as measured using the Hubble Space Telescope. *The Astrophysical Journal*, 783, 113.
3. Deming, L. D., A. Wilkins, P. McCullough, A. Burrows, J. J. Fortney, E. Agol, I. Dobbs-Dixon, N. Madhusudhan, N. Crouzet, J. Désert, R. L. Gilliland, K. Haynes, H. A. Knutson, M. Line, Z. Magic, A. M. Mandell, **S. Ranjan**, D. Charbonneau, M. Clampin, S. Seager, and A. P. Showman, 2013. Infrared Transmission Spectroscopy of the Exoplanets HD 209458b and XO-1b using the Wide Field Camera-3 On the Hubble Space Telescope. *The Astrophysical Journal*, 774, 95.
2. Cosgrove, R., M. Nicolls, H. Dahlgren, **S. Ranjan**, and R. Doe, 2010. Radar Detection of a Localized 1.4 Hz Pulsation in Auroral Plasma, Simultaneous with Pulsating Optical Emissions, During a Substorm. *Annales Geophysicae*, 28, 1961.
1. Nicolls, M. J., C. J. Heinselman, E.A. Hope, **S. Ranjan**, and M.C. Kelly, 2007. Imaging of Polar Mesosphere Summer Echoes with the 450 MHz Poker Flat Advanced Molecular Incoherent Scatter Radar. *Geophysical Research Letters*, 34, L20102.

Talks and Seminars

‡ = remote due to COVID-19

Invited

- TIFR Seminar, Mumbai, India‡. 05/2021.
- JPL Seminar, Pasadena, CA‡. 03/2021.
- MIT Planetary Lunch Seminar, Cambridge, MA‡. 11/2020.
- National Institute of Science Education and Research School of Earth and Planetary Sciences Colloquium. Bhubaneswar, India‡. 10/2020.
- Harvard-Smithsonian Center for Astrophysics Exoplanet Lunch. Cambridge, MA‡. 04/2020.
- UC Davis Origins Group Seminar. Davis, CA. 11/2019.
- Exoclimates 2019. Oxford, UK. 08/2019. **Keynote**.
- Northwestern University CIERA Theory Group Seminar. Evanston, IL. 04/2019.
- ELSI Seminar. Tokyo, Japan. 04/2019.
- XVth Rencontres du Vietnam: “Life3E’2019: Search for Life, From Early Earth to Exoplanets”. Quy Nhon, Vietnam. 03/2019. **Keynote**.
- Lorenz Center Workshop: “A Roadmap for Universal Life”. Leiden, The Netherlands. 10/2018.
- UC Riverside Astronomy Seminar. Riverside, CA. 10/2018.
- Goldschmidt Conference. Boston, MA. 08/2018.
- NASA GSFC SEEC “Seeds of Biomolecules” Conference. Greenbelt, MD. 04/2018.
- UMass Lowell Space Physics Seminar. Lowell, MA. 02/2018.
- MIT PICS Seminar. Cambridge, MA. 11/2017.
- Harvard-Smithsonian Center for Astrophysics Atomic and Molecular Physics Seminar. Cambridge, MA. 05/2017.
- Harvard Origins of Life Initiative Chalk Talk. Cambridge, MA. 02/2017.
- ELSI-Harvard Joint Workshop: The Chemical Origins of Life on Early Earth and Other Planetary Bodies. Cambridge, MA. 02/2015.

Contributed

- Stars and Planets in the Ultraviolet: A Cross-Community Symposium[‡]. 05/2021.
 - STScI 2021 Spring Symposium “Towards the Comprehensive Characterization of Exoplanets”[‡]. 04/2021.
 - Northwestern University Lunch Seminar. Evanston, IL[‡]. 02/2021.
 - SCOL Meeting. New York, NY[‡]. 11/2020.
 - DPS 52[‡]. Virtual Meeting[‡]. 10/2020.
 - Exoplanets III. Virtual Meeting[‡]. 07/2020.
 - 236th American Astronomical Society Meeting. Virtual Meeting[‡]. 06/2020.
 - Boston Area Exoplanet Science Meeting. Boston, MA[‡]. 04/2020.
 - Gordon Research Conference on the Origin of Life. Galveston, TX. 01/2020.
 - 235th American Astronomical Society Meeting. Honolulu, HI. 01/2020.
 - Habitability: Producing Conditions Conducive to Life. Bozeman, MT. 09/2019.
 - SCOL Meeting. New York, NY. 04/2019.
 - CU Boulder CASA/JILA Seminar. Boulder, CO. 02/2019.
 - FFAME Workshop: “Origins of Life”. Atlanta, GA. 10/2018.
 - SCOL Meeting. New York, NY. 10/2018.
 - COSPAR Meeting. Pasadena, CA. 07/2018.
 - “Science of Early Life” Conference. Hamilton, Canada. 06/2018.
 - Gordon Research Seminar. Galveston, TX. 01/2018.
 - Boston Area Exoplanets Meeting. Cambridge, MA. 12/2017.
 - Habitable Worlds: A System Science Workshop. 11/2017.
 - SCOL Meeting. New York, NY. 11/2017.
 - IIA Astrophysics Seminar. Bangalore, India. 06/2017.
 - 5th ELSI International Symposium. Tokyo, Japan. 01/2017.
 - American Astronomical Society Meeting. Grapevine, TX. 01/2017.
 - Caltech Geoclub Seminar. Pasadena, CA. 12/2016.
 - DTM Astronomy Seminar. Washington, DC. 11/2016.
 - Columbia Astronomy Seminar. New York, NY. 11/2016.
 - UChicago Exoplanets Group Seminar. Chicago, IL. 11/2016.
 - MIT Kavli Institute Brown Bag Lunch. Cambridge, MA. 10/2016.
 - NASA GISS Seminar. New York, NY. 10/2016.
 - NASA GSFC Exoplanet Seminar. Greenbelt, MD. 09/2016.
 - NASA Ames Space Science & Astrobiology Division Seminar. Moffett Field, CA. 09/2016
 - MRC LMB Seminar. Cambridge, UK. 08/2016.
 - University of St. Andrews Earth Science Seminar. St. Andrews, UK. 08/2016.
 - Cornell Planetary Lunch. Ithaca, NY. 05/2016.
 - Astrobiology Science Conference. Chicago, IL. 06/2015.
 - AGU Fall Meeting. San Francisco, CA. 12/2013.
 - AbGradCon. Montreal, Canada. 06/2013.
 - XXVIIIth IAU General Assembly. Beijing, China. 08/2012.
 - Extreme Solar Systems II. Jackson Hole, WY. 09/2011.
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Teaching

- **Guest Lecturer (11/2019)**, MIT Course: “Astrobiology, Origins and Early Evolution of Life”. Cambridge, MA. 11/2019.
 - **Teaching Fellow, Harvard University**. Taught (a) Celestial Navigation (2011). (b) How to Build a Habitable Planet (2012).
 - **Teaching Assistant, MIT**. Taught (a) Physics 1 (Fall 2007) (b) Hands-On Astronomy: Observing Stars and Planets (Spring 2009) (c) Observational Techniques of Optical Astronomy (Fall 2009).
 - **Teacher & Organizer, Observational Astronomy for High-School Students, Fall 2008, 2009**. Developed and taught evening class in observational astronomy for local high-school students. Included classroom and laboratory components and field trips.
 - **Teaching Assistant, Programa Joves i Ciencia, Summer 2008, 2009**. Taught astrophysics and observational astronomy to high school students in Spain. Included classroom and laboratory components.
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Mentorship

- **Mentor, AP Research (2020)**. Mentoring high school student in capstone project in AP Research class.
 - **Mentor, Research Science Institute (2019)**. Mentored high school student via Research Science Institute (RSI) program. Guided student through research project. Work won “Top 5 Presentation” honor at RSI; results being prepared for submission, with student due to be co-author on peer-reviewed paper. News coverage.
 - **Peer mentor (2012-2020)**. (1) Mentor for MIT freshmen from underrepresented backgrounds via Mentor Advocate Program (MAP; 2018-present). (2) Peer mentor for junior postdocs in MIT EAPS department (2018-present). (3) Mentor for graduate student in MIT EAPS department (2019-present). (4) Peer mentor for interns & junior graduate students in Harvard Astronomy department (2012-2015).
 - **Undergraduate Thesis Supervisor, Harvard University (2013-2015)**. Co-supervisor for undergraduate student completing junior and senior theses. Lead to a peer-reviewed publication in ChemComm.
 - **Mentor, SciPro, Spring 2007**. Guided local high-school students from underrepresented backgrounds through science project with objective to teach scientific methods, documentation, and presentation of results, as well as encourage consideration of STEM fields.
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Outreach

- **Author & Speaker (2012-present)**. Interviewee, speaker, and author for diverse science media, including NOVA, Science for the Public, Kavli Foundation, Science in the News and Wired.
 - **Organizing Committee, ComSciCon (2012, 2013)**. Co-founder and organizer for summer science communication workshop ComSciCon.
 - **Author, Astrobites (2011-2013)**. Author for astronomy outreach blog Astrobites
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Service

- **Peer reviewer** for *Astrobiology*, *Life*, *The Astrophysical Journal*, *AGU Advances*, *Icarus*.
 - **Member (2020-Present)** CIERA Astrophysics Seminar Committee.
 - **Interviewer (2011-present)**, MIT Undergraduate Admissions.
 - **Representative, Faculty Search Committee (2013-14)**. Elected representative to Harvard Astronomy department committee to select new professor.
 - **Representative, Graduate Student Council (2011-13)**. Elected representative to Harvard GSC.
 - **Representative, Committee on Curricula (2007-2009)**. Student representative to the MIT CoC.
 - **Representative, Committee on the Undergraduate Program (2009)**. Student representative to the MIT CUP.
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References

- **Professor Dimitar Sasselov**, Harvard University, dsasselov@cfa.harvard.edu.
- **Professor Sara Seager**, Massachusetts Institute of Technology, seager@mit.edu
- **Professor Andrew Babbín**, Massachusetts Institute of Technology, babbín@mit.edu
- **Professor Robin Wordsworth**, Harvard University, rwordsworth@seas.harvard.edu