
Professor Sara Seager Massachusetts Institute of Technology

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Citizenship: US citizen since 7/20/2010

Birthdate: 7/21/1971

Professional History

1/2011–present: Massachusetts Institute of Technology, Cambridge, MA USA

- Class of 1941 Professor (1/2012–present)
- Professor of Planetary Science (7/2010–present)
- Professor of Physics (7/2010–present)
- Professor of Aeronautical and Astronautical Engineering (7/2017–present)

1/2007–12/2011: Massachusetts Institute of Technology, Cambridge, MA USA

- Ellen Swallow Richards Professorship (1/2007–12/2011)
- Associate Professor of Planetary Science (1/2007–6/2010)
- Associate Professor of Physics (7/2007–6/2010)
- Chair of Planetary Group in the Dept. of Earth, Atmospheric, and Planetary Sciences (2007–2015)

08/2002–12/2006: Carnegie Institution of Washington, Washington, DC, USA

- Senior Research Staff Member

09/1999–07/2002: Institute for Advanced Study, Princeton NJ

- Long Term Member (02/2001–07/2002)
- Short Term Member (09/1999–02/2001)
- Keck Fellow

Educational History

1994–1999 Ph.D. “*Extrasolar Planets Under Strong Stellar Irradiation*”
Department of Astronomy, Harvard University, MA, USA

1990–1994 B.Sc. in Mathematics and Physics
University of Toronto, Canada
NSERC Science and Technology Fellowship (1990–1994)

Awards and Distinctions

Academic Awards and Distinctions

2018	American Philosophical Society Member
2018	American Academy of Arts and Sciences Member
2015	Honorary PhD, University of British Columbia
2015	National Academy of Sciences Member
2013	MacArthur Fellow
2012	Raymond and Beverly Sackler Prize in the Physical Sciences
2012	American Association for the Advancement of Science Fellow
2007	Helen B. Warner Prize, American Astronomical Society
2004	Bok Prize in Astronomy, Harvard University

Other

2013	Royal Astronomical Society of Canada, Honorary Lifetime Member
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Media Recognition

2012	Time Magazine: one of the 25 Most Influential in Space
2011	Nature: Named in 2011 Top Ten
2008	Discover Magazine: Named in Best 20 under 40
2006	Popular Science Magazine: Named in Fifth Annual Brilliant Ten

Other Professional Societies

1999–present	American Physical Society
1999–present	American Astronomical Society
2007–2011	American Geophysical Union

Space Science Mission Activities

Current

2016–2020	Deputy Science Director TESS (2016-present), a NASA Explorer Mission, launch 2018, (Co-I 2013–2016)
2008–2020	PI ASTERIA (formerly ExoplanetSat) a 6U CubeSat telescope operated by JPL, now on orbit

Past

2017–2019	PI of NASA-sponsored Starshade Probe Study
2015–2019	Co-Chair of the NASA-directed HabEx Study
2013–2016	TESS co-I, a NASA Explorer Mission, launch 2018
2013–2015	Chair of the NASA STDT for the Starshade Probe-Class Study
2011–2012	CDIO lead for REXIS (instrument on OSIRIS-Rex, a NASA New Horizons Mission, launch 2016)
2007–2011	Participating Scientist NASA/Kepler (launched 3/2009)
2008–2011	Co-I NASA/EPOXI Discovery Mission of Opportunity (formerly the NASA Deep Impact Spacecraft)
2008–2009	Deputy Mission Scientist for TESS, a NASA/SMEX proposal through Phase A
2003–2008	Support Scientist, CSA/MOST (Microvariability and Oscillations of Stars (MOST) microsatellite) (launched June 2003)
2004–2006	NASA TPF Scientific and Technology Definition Team
2002–2004	NASA TPF Scientific Working Group

2000–2001

Ball Aerospace TPF Architecture Study Team

Selected External Committee Membership

2017–2018	Handbook of Exoplanets, Springer, Committee and Chapter Lead
2013–2015	Co-Chair, Beyond JWST Committee (AURA)
2009–2013	James Webb Space Telescope Advisory Committee (JSTAC)
2008–2012	Spitzer Science Center Oversight Committee (Spitzer Space Telescope)
2007–2010	National Academy of Sciences NRC Committee on the Origin and Evolution of Life
2006–2008	Space Telescope Science Institute (HST) Visiting Committee
2007–2008	NASA/NSF Exoplanet Task Force
2005	James Webb Space Telescope Science Assessment Team
2004–2005	National Academy of Sciences Astronomy and Astrophysics Mid Course Review
2004–2005	NSF Optical and Infrared Long Range Planning Committee
2002–2005	Chair, NASA Astrobiology Astronomy Focus Group
2002	NASA Origins Roadmap Committee

Conference Scientific Organizing Committees

2018	•"TESS Science Conference I", Cambridge, MA
2015	•"ExoClimes", Kona, HI
2013	•"Search for Life Beyond the Solar System", Tucson, AZ
2012	•"Characterizing and Modeling Extrasolar Planetary Atmospheres: Theory and Observations", Heidelberg, Germany
2011	•"Exploring Strange New Worlds: from Giant Planets to Super Earths", Flagstaff, AZ
2010	•Third Workshop Stellar Observation Network Group (SONG), China
2009	•"Towards Other Earths", Portugal
	•"Pathways Towards Habitable Planets", Barcelona, Spain
2008	•"Characteristics and Habitability of Super Earths," Aspen Center for Physics,
	•"Extrasolar Super-Earths," Nantes, France
	•"Transiting Planets," International Astronomical Union (IAU) Symposium 253, Boston
2006	•"The 4 th International TPF/Darwin Workshop," Pasadena, CA,
2005	•"Direct Imaging of Exoplanets," IAU Colloquium 200, France
2003	•14th Annual Maryland Astrophysics Conference: "The Search for Other Worlds," MD
2002	•Co-Chair for "Scientific Frontiers in Extrasolar Planet Research," Washington DC

Current Research Group Members

(EAPS = MIT Dept. of Earth, Atmospheric, and Planetary Sciences; Physics = MIT Dept. of Physics; Aero-Astro = MIT Dept. of Aeronautical and Astronautical Engineering

*= co-supervised)

Exoplanet Characterization (Primarily Computer Modeling and Data Interpretation)

Name	Dept.	Position	Topic
Mariona Badenas	EAPS	Grad Student	Exoplanets

Zahra Essak	EAPS	Grad Student	Exoplanets
Ana Glidden	EAPS	Grad Student	Exoplanets
Jingcheng Huang	Chem.	Grad Student	Exoplanet Atmospheres
Akshata Krishnamurthy	Aero-Astro	Grad Student	Systems, Structures
Nicholas Merle	Physics	Grad Student	Exoplanets
Tajana Schneiderman	EAPS	Grad Student	Exoplanets
Zhuchang Zhan	EAPS	Grad Student	Exoplanets
Goran Zivanovic	EECS	Grad Student	TESS Data

Jason Dittman	EAPS	51 Peg Fellow	Exoplanet Observations
Tom Evans	Kavli	Postdoc	Exoplanet Observations
Maximillian Guenther	Kavli	Torres Fellow	Exoplanet Observations
Chelsea Huang	Kavli	Torres Fellow	Exoplanet Observations
Elisabeth Matthews	Kavli	Postdoc	Exoplanet Observations
Janusz Petkowski	EAPS	Res. Scientist	Biochemistry
Sukrit Ranjan	EAPS	Simons Fellow	Biosignatures
Clara Sousa-Silva	EAPS	Res. Scientist	Quantum Astrochemistry

Past Research Group Members

(EAPS = MIT Dept. of Earth, Atmospheric, and Planetary Sciences; Physics = MIT Dept. of Physics; Aero-Astro = MIT Dept. of Aeronautical and Astronautical Engineering)

Past Postdoctoral Fellows

Name	Dept.	Current Position
Jenn Burt	Kavli	JPL Postdoc
Mary Knapp	EAPS	Staff at MIT Haystack Observatory
Vlada Stamenkovic	EAPS/SNS Fellow	JPL Staff
Andras Zsom	EAPS/DFG Fellow	Unknown
Nikole Lewis	EAPS/Sagan Fellow	Cornell University Faculty
Brice Demory	EAPS	Research Prof. Bern, Switzerland
Alessandra Babuscia	MIT Aero-Astro	JPL Staff
Diana Valencia	MIT EAPS Sagan Fellow	U. of Toronto Faculty
Margaret Turnbull	Carnegie NRC Fellow (2004–2006)	GSI
L. Jeremy Richardson	GSFC NRC Fellow (2004–2006)	Unknown
Kaspar von Braun	Carnegie Fellow (2002–2005)	MPIA

Past MIT PhD Students

Name	Dept.	Current Position
Mary Knapp	EAPS (2012-2017)	MIT Haystack Observatory Staff
Stephen Messenger	EAPS (2009-2015)	Unknown
Ben Corbin	Aero-Astro (2012-2015)	Unknown
Julien de Wit	EAPS (2010-2014)	MIT Faculty
Matthew Smith	Aero-Astro (2010-2014)	JPL Staff
Julien de Wit	EAPS (2011–2013)	MIT Faculty
Bjoern Benneke	Aero-Astro (2010–2013)	U. Montreal Faculty
Renyu Hu	EAPS (2009–2013)	JPL Staff
Leslie Rogers	Physics (2007-2012)	U. Chicago Faculty
Nikku Madhusudhan	Physics (2008–2009)	Reader at Cambridge, UK

Past Masters or Other PhD Students

Name	Dept.	Current Position
Jared Atkinson	EAPS	Honeybee Robotics
Niraj Inamdar	Mech E./EAPS	Aerospace Corporation
*Jameson Nash	Aero-Astro Masters	Unknown

Rachel Bowens-Rubin	EAPS Masters	Unknown
Luyao Li	EAPS Masters	Unknown
Thomas Beatty	Physics Masters (2008–2009)	U. Arizona astronomer
Ben Hood	PhD (11/2005–1/2007)	Industry

Selected Past Undergraduate Research Students (* = Senior Thesis)

Name	Dept. (year of position)	Current Position
Zsuzsa Megyery	EAPS (2013)	Industry
Becky Jensen-Clem	Physics (2010-2012)	Caltech graduate student
Sukrit Ranjan	Physics (2009)	Simons Fellow MIT
Ana-Maria Piso	Physics/EAPS (2011)	UCLA Postdoctoral Fellow
*Sarah Gelman	EAPS (2009)	Exxon Mobil Senior Geologist
*Li Zeng	Physics (2007–2009)	Simons Fellow Harvard
Sonali Shukla	Carnegie Summer Intern (2005)	New York University Faculty

Named or Prize Lectures

2020	<ul style="list-style-type: none"> •Stanley Miller Memorial Lecture, UC San Diego, CA •Finkelstein Bold Ideas lecture, Georgia Tech, GA •Rittenhouse Lecture, U. Penn, PA
2019	<ul style="list-style-type: none"> •Brinson Lecture, University of Chicago, IL
2018	<ul style="list-style-type: none"> •J. Tuzo Wilson Public Lecture, University of Toronto, ON, Canada •Elizabeth Laird Public Lecture, Memorial University, NL, Canada •Origins Prize Lecture, Harvard University, MA •Pickering Lecture, AIAA Space, Orlando, FL •Bunyan Lecture, Stanford University •Iben Lecture, University of Illinois •Nier Lecture, University of Minnesota •Mutch Lecture, Brown University Rhode Island
2017	<ul style="list-style-type: none"> •MacLennan Lecture, St. Mary's U., Halifax, NS, Canada •Provigo Lecture, Bishop's U., Sherbrooke, PQ, Canada
2015	<ul style="list-style-type: none"> •Sturm Lecture, Wesleyan University, CT •Mohler Prize Lecture, U. Michigan •Sackler Lecturer, IoA Cambridge, UK
2011	<ul style="list-style-type: none"> •Page-Barbour Lecturer, University of Virginia, VA •Salpeter Lecturer, Cornell University, NY
2010	<ul style="list-style-type: none"> •Biermann Lecturer, Max Planck Institute for Astrophysics, Garching, Germany •Foster-Hewitt Lecturer, Lehigh University, PA •Nova Lecturer, Netherlands
2009	<ul style="list-style-type: none"> •John Bahcall Lecturer, NASA: STScl and GSFC
2008	<ul style="list-style-type: none"> •Dr. H. Lyman Hooker Distinguished Visiting Professor, McMaster University, Canada •<i>Spitzer</i> Distinguished Visiting Scientist, Spitzer Science Center, CA

Selected Recent Keynote or Plenary Talks at Conferences

2018	<ul style="list-style-type: none"> •Goldschmidt Conference, Boston, MA •SPIE Conference, Austin, TX •Conference on Lasers and Electro-optics (CLEO), San Jose, CA
2015	<ul style="list-style-type: none"> •Canadian Association of Physicists, Alberta, Canada •IEEE, Big Sky, MT
2014	<ul style="list-style-type: none"> •The Search for Life Beyond the Solar System, Tucson, AZ

2010	•SPIE Plenary Talk, CA
2009	•Vatican Astrobiology Workshop, Italy
2008	•New Vision 400, Beijing, China •COSPAR Plenary Talk, Montreal, PQ

Recent Selected Public Talks

2018	COSPAR	Pasadena	CA
2017	STARMUS	Trondheim	Norway
2015	TED	Vancouver	Canada
2014	CPSX distinguished public lecture	U. Western Ontario	ON
2013	RASC General Assembly	Lakehead University	Canada

Selected Scientific Publications (*=Student or Postdoc in Seager's Research Group)

h-index = 75. Citation count > 20,000. Number of refereed publications > 200.

27 published TESS papers in 2018-2019

*Petkowski J. J., Bains, W., C., **Seager, S.** 2019, "Natural Products Containing 'Rare' Organophosphorus Functional Groups", *Molecules*, 24, 866-931.

*Günther, M. N., Zhan, Z., **Seager, S.**, and 19 coauthors, "Stellar Flares from the First TESS Data Release: Exploring a New Sample of M-dwarfs", *Submitted to AAS Journals*.

*Sousa-Silva, C., Petkowski J. J., **Seager, S.** 2019, "Molecular Simulations for the Spectroscopic Detection of Atmospheric Gases", *Physical Chemistry Chemical Physics*, 21, 18970-18987.

*Sousa-Silva, C., **Seager, S.**, Petkowski J. J., Sukrit, R., Zhan, Z., Hu, R., Bains, W., "On Phosphine as a Biosignature Gas in Exoplanet Atmospheres", *Astrobiology, in press*.

Bains, W., Petkowski J. J., Sousa-Silva, C., **Seager, S.** 2019, "Trivalent Phosphorus and Phosphines as Components of Biochemistry in Anoxic Environments", *Astrobiology*, 19, 885-902.

Bains, W., Petkowski J. J., Sousa-Silva, C., **Seager, S.** 2019, "New environmental model for thermodynamic ecology of biological phosphine production", *Science of the Total Environment*, 658, 521-536.

Seager, S. 2018, "The Search for Habitable Planets with Biosignature Gases framed by a 'Biosignature Drake Equation'", *International Journal of Astrobiology*, 17, 294.

*Petkowski J. J., Bains W., **Seager S.** 2019, "An Apparent Binary Choice in Biochemistry: Mutual Reactivity Implies Life Chooses Thiols or Nitrogen-Sulfur Bonds, but not Both", *Astrobiology*, 19, 579-613.

*Petkowski J. J., Bains W., **Seager S.** 2018, "Natural Products Containing a Nitrogen-Sulfur Bond", *Journal of Natural Products*, 81, 423-446.

Gaudi, B. S., Mennesson, B., **Seager, S.**, and 25 coauthors. 2018 “The Habitable Exoplanet Observatory (HabEx)”, *SPIE*, 10698, 106980.

Deming, L. D., **Seager, S.** 2017, “Illusion and Reality in the Atmospheres of Exoplanets”, *Journal of Geophysical Research*, 122, 53-75.

Seager, S., Bains, W., & Petkowski, J. J. 2016, “Toward a List of Molecules as Potential Biosignature Gases for the Search for Life on Exoplanets and Applications to Terrestrial Biochemistry”, *Astrobiology*, 16, 465-485.

Seager, S., Bains, W. 2015, “The Search for Signs of Life at the Interface of Chemistry and Planetary Science”, *Science Advances*, 1, 47.

Seager, S., et al. 2015, “The Exo-S Probe-Class Starshade Mission”, *SPIE*, 9605, 96050W.

*R. Hu, **S. Seager**, and Y. L. Yung 2015, “Helium Atmospheres on Warm Neptune- and Sub-Neptune-Sized Exoplanets and Applications to GJ 436b”, *Astrophysical Journal*, 807, 8-21.

Ferreira, D., Marshall, J., O’Gorman, P. A., **Seager, S.** 2015, “Climate at High Obliquity”, *Icarus*, 243, 236-248.

Seager, S. 2014, “The Future of Spectroscopic Life Detection on Exoplanets”, *PNAS*, 111, 12634-12640.

*Hu, R. & **Seager, S.** 2014, “Photochemistry in Terrestrial Exoplanet Atmospheres. III. Photochemistry and Thermochemistry in Thick atmospheres on Super Earths and Mini Neptunes”, *Astrophysical Journal*, 784, 63-87.

*Hu, R., **Seager, S.** & Bains, W. 2013, “Photochemistry in Terrestrial Exoplanet Atmospheres. II. H₂S and SO₂ Photochemistry in Anoxic Atmospheres”, *Astrophysical Journal* 769, 6-19.

*de Wit, J., **Seager, S.** 2013, “Constraining Exoplanet Mass from Transmission Spectroscopy”, *Science*, 342, 1473-1477.

*Zsom, A., de Wit, J., Stamenkovic, V., **Seager, S.** 2013, “Toward the Minimum Inner Edge Distance of the Habitable Zone”, *ApJ*, 778, 109-125.

Seager, S., Bains, W., & Hu, R. 2013 “Biosignature Gases in H₂-Dominated Atmospheres on Rocky Exoplanets”, *ApJ*, 777, 95-113.

Seager, S., Bains, W., & Hu, R. 2013, “A Biomass-Based Model to Estimate the Plausibility of Exoplanet Biosignature Gases”, *ApJ*, 775, 104-127.

Seager, S. 2013, “Exoplanet Habitability”, *Science*, 340, 577-581.

Seager, S., Schrenk, M., & Bains, W. 2012, “An Astrophysical View of Earth-Based Metabolic Biosignature Gases”, *Astrobiology*, 12, 61-82.

*Hu, R., **Seager, S.** & Bains, W. 2012, “Photochemistry in Terrestrial Exoplanet Atmospheres. I. Photochemistry Model and Benchmark Cases.” *Astrophysical Journal*, 761, 166-194.

*Hu, R., Ehlmann, B. L. & **Seager, S.** 2012, “Theoretical Spectra of Terrestrial Exoplanet Surfaces”, *Astrophysical Journal*, 752, 7-21.

*Demory, B.-O., & **Seager, S.** 2011, “Lack of Inflated Radii for Kepler Giant Planet Candidates Receiving Modest Stellar Irradiation”, *ApJS*, 197, 12-16.

*Demory, B.-O., Gillon, M., Deming, D., Valencia, D., **Seager, S.**, Benneke, B., Lovis, C., Cubillos, P., Harrington, J., Stevenson, K. B., and 4 coauthors 2011, "Detection of a Transit of the Super-Earth 55 Cancri e with Warm Spitzer", A&A, 533, 114.

Seager, S., & Deming, D. 2010, "Exoplanet Atmospheres", Ann. Rev. Astron. and Astrophys., 48, 631-672.

*Rogers, L. A., & **Seager, S.** 2010, "Three Possible Origins for the Gas Layer on GJ 1214b", ApJ, 716, 1208-1216.

*Rogers, L. A., & **Seager, S.** 2010, "A Framework for Quantifying the Degeneracies of Exoplanet Interior Compositions", ApJ, 712, 974-991.

*Madhusudhan, N., & **Seager, S.** 2009, "A Temperature and Abundance Retrieval Method for Exoplanet Atmospheres", ApJ, 707, 24-39.

Seager, S., & Deming, D. "On the Method to Infer an Atmosphere on a Tidally-Locked Super Earth Exoplanet and Upper limits to GJ 876d", ApJ, 703, 1884-1889.

*Miller-Ricci, E., **Seager, S.**, & Sasselov, D. 2009, "The Atmospheric Signatures of Super-Earths: How to Distinguish Between Hydrogen-Rich and Hydrogen-Poor Atmospheres", ApJ, 690, 1056-1067.

Seager, S., Kuchner, M., Hier-Majumder, C. A., & Militzer, B. 2007, "Mass-Radius Relationships for Solid Exoplanets", ApJ, 669, 1279-1297.

Seager, S., Richardson, L. J., Hansen, B. M. S., Menou, K, Cho, J., & Deming, D. 2005, "On the Day Side Thermal Emission of Hot Jupiters", ApJ, 632, 1122-1131.

Deming, D., **Seager, S.**, Richardson, L. J., & Harrington, J. 2005, "Detection of Infrared Radiation from an Extrasolar Planet", Nature, 434, 740-743.

Seager, S., & Mallen-Ornelas, G. 2003, "On the Unique Solution of Planet and Star Parameters from an Extrasolar Planet Transit Light Curve", ApJ, 585, 1038-1055.

*Ford, E. B., **Seager, S.**, & Turner, E. L. 2001, "Characterization of Extrasolar Terrestrial Planets from Diurnal Photometric Variability", Nature, 412, 885-887.

Seager, S., Whitney, B. A., & Sasselov, D. D. 2000, "Light Curves and Polarization of the Close-in Extrasolar Giant Planets", ApJ, 540, 504-520.

Seager, S., & Sasselov, D. D. 2000, "Theoretical Transmission Spectra During an Extrasolar Giant Planet Transit", ApJ, 537, 916-921.

Seager, S., Sasselov, D. D., & Scott, D. 2000, "How Exactly Did the Universe Become Neutral?", ApJS, 128, 407-430.

Seager, S., Sasselov, D. D., & Scott, D. 1999, "A New Calculation of the Recombination Epoch", 1999, ApJ, 523, L1-5.

Seager, S., & Sasselov, D. D. 1998, "Extrasolar Giant Planets Under Strong Stellar Irradiation", ApJ, 502, L157-161.

Books

Seager, S. 2010, "Exoplanet Atmospheres: Physical Processes", Princeton University Press, ISBN: 978-1-4008-3530-0

Seager, S. (editor) 2010, "Exoplanets", University of Arizona Press, ISBN: 978-0816529452

Invited Autobiographical Essay, "Astrobiology Pioneers"

Seager, S. 2012, "Written in the Stars", *Astrobiology*, 12, 83-88.