

Maria E. Steinrueck

Max-Planck-Institute for Astronomy
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Education

University of Arizona, Tucson, AZ, USA 2016–2021

PhD in Planetary Sciences. December 2021.

M.S. in Planetary Sciences. December 2018.

Vienna University of Technology, Vienna, Austria 2010–2015

M.S. in Technical Physics, specializing in Theoretical Physics. Graduated with distinction in November 2015.

B.S. in Technical Physics. Graduated with distinction in August 2013.

University of Washington, Seattle, WA, USA 2013–2014

Transatlantic Science Student Exchange Program – Study Abroad (full academic year)

Professional Experience

51 Pegasi b Fellow starting September 2023

Department of Astronomy and Astrophysics, University of Chicago

APEX Prize Postdoctoral Fellow 2022–current

Atmospheric Physics of Exoplanets (APEX) Department, Max Planck Institute for Astronomy, Heidelberg

NASA Earth and Space Sciences Fellow 2018–2021

Graduate Research and Teaching Assistant 2016–2021

Lunar and Planetary Laboratory, University of Arizona

Advisor: Prof. Adam Showman (deceased, 2020), Prof. Tommi Koskinen

Publications

First- and second-author publications

Steinrueck, M. E., Koskinen, T., Lavvas, P., Parmentier, V., Zieba, S., Tan, X., Zhang, X., Kreidberg, L. (2023): Photochemical hazes dramatically alter temperature structure & atmospheric circulation in 3D simulations of hot Jupiters. Accepted for publication in The Astrophysical Journal, arXiv:2305.09654.

Tsai, S.-M., **Steinrueck, M. E.**, Parmentier, V., Lewis, N. K., Pierrehumbert, R. (2022): The Climate and Compositional Variation of the Highly Eccentric Planet HD 80606 b—the rise and fall of carbon monoxide and elemental sulfur. Monthly Notices of the Royal Astronomical Society, 520, 3867–3886, doi:10.1093/mnras/stad214.

Steinrueck, M. E., Showman, A. P., Lavvas, P., Koskinen, T., Zhang, X., Tan, X. (2021): 3D Simulations of Photochemical Hazes in the Atmosphere of Hot Jupiter HD 189733b. Monthly Notices of the Royal Astronomical Society, 504, 2783–2799, doi:10.1093/mnras/stab1053.

Steinrueck, M. E., Parmentier, V., Showman, A. P., Lothringer, J. D., Lupu, R. E. (2019): The Effect of Disequilibrium Carbon Chemistry on the Atmospheric Circulation and Phase Curves of Hot Jupiter HD 189733b. The Astrophysical Journal, 880, 14, doi:10.3847/1538-4357/ab2598.

Vorobyov, E. I., **Steinrueck, M. E.**, Elbakyan, V., Guedel, M. (2017): Formation of freely floating sub-stellar objects via close encounters. *Astronomy & Astrophysics*, 608, A107, doi:10.1051/0004-6361/201731565.

Co-author publications

Kempton, E. M.-R., Zhang, M., Bean, J. L., **Steinrueck, M. E.**, Piette, A. A. A., Parmentier, V., Malsky, I., Roman, M. T., Rauscher, E., Gao, P., Bell, T. J., Xue, Q., Taylor, J., Savel, A. B., Arnold, K. E., Nixon, M. C., Stevenson, K. B., Mansfield, M., Kendrew, S., Zieba, S., Ducrot, E., Dyrek, A., Lagage, P.-O., Stassun, K. G., Henry, G. W., Barman, T., Lupu, R., Malik, M., Kataria, T., Ih, J., Fu, G., Welbanks, L., McGill, P. (2023): A reflective, metal-rich atmosphere for GJ 1214b from its JWST phase curve. *Nature*, doi:10.1038/s41586-023-06159-5.

Gao, P., Piette, A. A. A., **Steinrueck, M. E.**, Nixon, M. C., Zhang, M., Kempton, E. M.-R., Bean, J. L., Rauscher, E., Parmentier, V., Batalha, N. E., Savel, A. B., Arnold, K. E., Roman, M. T., Malsky, I., Taylor, J. (2023): The Hazy and Metal-Rich Atmosphere of GJ 1214 b Constrained by Near and Mid-Infrared Transmission Spectroscopy. Accepted for publication in *The Astrophysical Journal*, arXiv:2305.05697.

Christie, D. A., Lee, E. K. H., Innes, H., Noti, P., Charnay, B., Fauchez, T., Mayne, N. J., Deitrick, R., Ding, F., Greco, J., Hammond, M., Malsky, I., Mandell, A., Rauscher, E., Roman, T., Sergeev, D., Sohl, L., **Steinrueck, M. E.**, Turbet, M., Wolf, E. T., Zamyatina, M., Carone, L. (2022): CAMEMBER: A Mini-Neptunes GCM Intercomparison, Protocol Version 1.0. A CUISINES Model Intercomparison Project. *The Planetary Science Journal*, 3, 261, doi:10.3847/PSJ/ac9dfe.

The JWST Transiting Exoplanet Community Early Release Science Team (incl. **Steinrueck, M. E.** in authorship tier 3) (2022): Identification of carbon dioxide in an exoplanet atmosphere. *Nature*, 614, 649–652, doi:10.1038/s41586-022-05269-w.

King, G. W., Corrales, L., Wheatley, P. J., Lavvas, P., **Steinrueck, M. E.**, Bourrier, V., Ehrenreich, D., Lecavelier des Etangs, A., Loudon, T. (2021): The near-UV transit of HD189733b with the XMM-Newton Optical Monitor. *Monthly Notices of the Royal Astronomical Society*, 506, 2453-2458, doi:10.1093/mnras/stab1863.

Venot, O., Parmentier, V., Blečić, J., Cubillos, P. E., Waldmann, I. P., Changeat, Q., Moses, J. I., Tremblin, P., Crouzet, N., Gao, P., Powell, D., Lagage, P.-O., Dobbs-Dixon, I., **Steinrueck, M. E.**, Kreidberg, L., Batalha, N., Bean, J. L., Stevenson, K. B., Casewell, S., Carone, L. (2020): Global Chemistry and Thermal Structure Models for the Hot Jupiter WASP-43b and Predictions for JWST. *The Astrophysical Journal*, 890, 176, doi:10.3847/1538-4357/ab6a94.

Helling, Ch., Iro, N., Corrales, L., Samra, D., Ohno, K., Alam, M. K., **Steinrueck, M.**, Lew, B., Molaverdikhani, K., MacDonald, R. J., Herbort, O., Woitke, P., Parmentier, V. (2019): Understanding the atmospheric properties and chemical composition of the ultra-hot Jupiter HAT-P-7b. I. Cloud and chemistry mapping. *Astronomy & Astrophysics*, 631, A79, doi:10.1051/0004-6361/201935771.

Lavvas, P., Koskinen, T., **Steinrueck, M.**, García Muñoz, A., Showman, A. P. (2019): Photochemical hazes in sub-Neptunian atmospheres with focus on GJ 1214b. *The Astrophysical Journal*, 878, 2, 118, doi:10.3847/1538-4357/ab204e.

Conference Presentations

Steinrueck, M. E. (January 2023): Photochemical hazes dramatically alter atmospheric circulation and temperature structure of short-period giant planets. Oral presentation at Cloud Zwei Con.

Steinrueck, M. E. (November 2022): Radiative feedback of photochemical hazes in GCMs of hot Jupiters and mini-Neptunes. Oral presentation at the *Celebrating JWST's first six months of exoplanet data* workshop.

Steinrueck, M. E., Koskinen, T., Lavvas, P., Parmentier, V., Tan, X., Zhang, X. (September 2022): Photochemical hazes dramatically alter temperature structure & atmospheric circulation in 3D simulations of hot Jupiters. Oral presentation at the European Planetary Science Congress.

Steinrueck, M. E., Koskinen, T, Parmentier, V., Lavvas, P., Tan, X., Zhang, X. (May 2022): Simulating radiative feedback of photochemical hazes in general circulation models of hot Jupiters. Poster presentation at Exoplanets IV.

Steinrueck, M. E., Koskinen, T, Lavvas, P., Tan, X., Zhang, X. (October 2021): Simulating radiative feedback of photochemical hazes in general circulation models of hot Jupiters. Oral presentation at the 53rd Meeting of the Division for Planetary Science.

Steinrueck, M. E., Koskinen, T, Lavvas, P., Tan, X., Zhang, X. (September 2021): Simulating radiative feedback of photochemical hazes in general circulation models of hot Jupiters. Oral presentation at the European Planetary Science Congress.

Steinrueck, M. E., Koskinen, T, Lavvas, P., Tan, X., Zhang, X. (August 2021): Simulating radiative feedback of photochemical hazes in general circulation models of hot Jupiters. Oral presentation at Cloud Nine Con.

Steinrueck, M. E., Showman, A. P., Koskinen, T, Lavvas, P., Zhang, X., Tan, X. (October 2020): Three-dimensional Simulations of Photochemical Hazes in the Atmosphere of Hot Jupiter HD 189733b. Oral presentation at the 52nd Meeting of the Division for Planetary Science.

Steinrueck, M. E., Showman, A. P., Koskinen, T, Lavvas, P., Zhang, X., Tan, X. (September 2020): Three-dimensional Simulations of Photochemical Hazes in the Atmosphere of Hot Jupiter HD 189733b. Oral presentation at the European Planetary Science Congress.

Steinrueck, M. E., Showman, A. P., Koskinen, T, Lavvas, P. (September 2019): Three-Dimensional Mixing of Photochemical Hazes in the Atmospheres of Hot Jupiters. Poster presentation at the European Planetary Science Congress and Division for Planetary Science Joint Meeting.

Steinrueck, M. E., Showman, A. P., Koskinen, T, Lavvas, P. (August 2019): Three-Dimensional Mixing of Photochemical Hazes in the Atmospheres of Hot Jupiters. Poster presentation at Extreme Solar Systems IV.

Steinrueck, M. E., Parmentier, V., Showman, A. P., Lothringer, J. D., Lupu, R. E. (June 2019): The Effect of Disequilibrium Carbon Chemistry on the 3-D Atmospheric Structure and Phase Curves of Hot Jupiters. Oral presentation at the 29th Bay Area Exoplanets Meeting.

Steinrueck, M. E., Parmentier, V., Showman, A. P., Lothringer, J. D., Lupu, R. E. (January 2019): The effect of disequilibrium carbon chemistry on the atmospheric circulation and phase curves of hot Jupiters. Oral presentation at the 233rd Meeting of

the American Astronomical Society.

Steinrueck, M. E., Parmentier, V., Showman, A. P., Lothringer, J. D., Lupu, R. E. (September 2018): The effect of disequilibrium carbon chemistry in general circulation models of hot Jupiters. Poster presentation at the Cloud Academy at the Les Houches School of Physics.

Steinrueck, M. E., Parmentier, V., Showman, A. P. (October 2017): The effects of disequilibrium carbon chemistry in general circulation models of hot Jupiters. Oral presentation at the 49th Division for Planetary Science meeting.

Observing Proposals (as Co-I)

Espinoza, N. and 39 Co-Is (incl. Steinrueck, M.) (2023): Hot Jupiter Atmospheric Forecast: are mornings cloudier than evenings in other worlds? JWST Proposal ID #3969. (61.53 hours)

Kreidberg, L. and 64 Co-Is (incl. **Steinrueck, M.**) (2022): The SPACE Program: A Sub-neptune Planetary Atmosphere Characterization Experiment. Hubble Proposal ID #17192. (205 orbits)

Parmentier, V., Evans, T., Kreidberg, L., Guenther, M., **Steinrueck, M.**, Crossfield, I., Irwin, P., Aigrain, S., Line, M., Van Eylen, V., Taylor, J. (2019): Seeing through the haze of two mini-Neptunes with Spitzer. Spitzer Proposal ID #14325. (26.1 hours)

Awards

51 Pegasi b Fellowship, Heising-Simons Foundation 2023-2026

APEx Prize Postdoctoral Fellowship (fellowship duration: 4 years), Max Planck Institute for Astronomy, 2022-2023

NASA Earth and Space Sciences Fellowship (NESSF), 2018-2021

Peter W. Likins Award for Inclusive Excellence (Student category), Univ. of Arizona, 2020

Galileo Circle Scholarship College of Science, Univ. of Arizona, 2018 & 2020

Leif Andersson Graduate Student Award for Service Lunar and Planetary Laboratory, Univ. of Arizona, 2018

Leistungsstipendium (Academic Merit Award) Vienna University of Technology, 2012

Travel Grants

Other Worlds Laboratory (OWL) Mini-Grant for a collaborative stay at the Université de Reims, Champagne-Ardenne, France, 2019

Other Worlds Laboratory (OWL) Mini-Grant for travel to the Extreme Solar Systems IV Meeting, 2019

GPSC Travel Grant Graduate and Professional Student Council (GPSC), Univ. of Arizona, 2018 & 2019

Lunar and Planetary Laboratory Student/Staff Travel Award, Univ. of Arizona, 2019

Theoretical Astrophysics Program Small Grant Univ. of Arizona, 2019

Hartmann Student Travel Grant Division for Planetary Science/AAS, 2017

Seminars and Colloquia

Seminar talk, Astronomy Department, University of Wisconsin-Madison (October 2022)

Science Talk, 17th Heidelberg Summer School, International Max Planck Research School for Astronomy and Cosmic Physics at the University of Heidelberg (August 2022)

Crater Café, Department of Earth, Atmospheric and Planetary Sciences, Purdue University (May 2022)

Königstuhl Colloquium, Max Planck Institute for Astronomy (March 2022)

Exoplanet, Star, and Planet Formation (ESPF) Seminar, Space Telescope Science Institute (May 2021)

Origins Seminar, University of Arizona (March 2021)

Exo-Coffee, MPA Heidelberg (September 2020)

Planetary Lunch, UC Santa Cruz (September 2020)

Presentation at Exoplanets & Disks Meeting, University of Amsterdam (September 2020)

Planetary and Exoplanetary Astronomy Seminar, University of Maryland (September 2020)

Astronomy Colloquium, Jet Propulsion Laboratory (August 2020)

Exoplanet Atmospheres Seminar, Geneva Observatory (March 2020)

Presentation to Exoplanet Atmospheres Group, Center for Space and Habitability, University of Bern (March 2020)

Seminar talk, Institute for Astrophysics, University of Vienna (September 2019)

Origins Seminar, University of Arizona (April 2019)

Teaching & Mentoring Experience

Students advised

David Haegeler (undergraduate student, March–July 2023)

Nicole Wolff (MPIA summer internship student, July–September 2022)

Berk Demirci (undergraduate student in Visual FX and 3D Animation at SAE Institute Vienna, co-advised for bachelor's thesis on creating a realistic 3D rendering of a scene set on the surface of Titan, provided advising from a science perspective, June 2021–February 2022)

Lunar and Planetary Laboratory, University of Arizona 2017–2018

Teaching assistant for the following courses:

- *PTYS 170B2 The Universe and Humanity: Origins and Destiny* (Spring semester 2017 and 2018)
- *PTYS 170A1 Planet Earth: Evolution of the Habitable World* (Fall semester 2017)

Pupils Attending University 2012–2015

Program enabling high school students to enroll early at university, run by the Austrian Research and Support Centre for the Gifted and Talented (OEZBF)

- Mentored four students over the course of a year each

Institute for Theoretical Physics, Vienna University of Technology 2011–2014

Teaching assistant for the following courses:

- *Quantum Mechanics 1* (Fall semester 2014 and 2012)
- *Electrodynamics 1* (Spring semester 2013)
- *Mathematical Methods of Theoretical Physics* (Fall semester 2011)

Outreach

German-language JWST First Images Event, Haus der Astronomie, Heidelberg, Germany July 2022

15-minute talk on the first JWST exoplanet spectrum as part of a 2-hour-long event with 5 speakers to an in-person audience of ca. 50 members of the general public and a livestream audience of 560. (<https://youtu.be/KNFxH81I39U?t=5884>; over 60,000 views as of November 2022)

Science Careers for Students at Oscar F. Smith High School, Chesapeake, Virginia May 2021

Panelist on a remote panel (via Zoom) for an audience of 16 high school students

Faszination Astronomie Online (Fascination Astronomy Online) February 2021

30-minute-long virtual talk in German titled “Wie photochemischer Dunst die Atmosphären von Exoplaneten verschleiert” (How Photochemical Hazes Obscure the Atmospheres of Exoplanet). Part of an outreach series organized by Haus der Astronomie Heidelberg (<https://youtu.be/-z8gRkC39ws>; over 1,500 views as of July 2022)

Lunar and Planetary Laboratory, University of Arizona 2016–2021

Volunteer at the graduate student outreach booth at a range of events

The Art of Planetary Science, University of Arizona 2017-2019

Volunteer at the art exhibition helping with setup, information desk, monitoring floors and taking down art after the event

University of Arizona Women’s Hackathon 2016–2018

Member of the organizing committee of the University of Arizona Women’s Hackathon (formerly Women Techmakers Tucson Hackathon)

Strange New Worlds: A Star Trek and Science Podcast 2017

Guest on Episode 18: *The Chemistry & Clouds of Hot Jupiters* (<https://tinyurl.com/yyj5wx4b>) and Episode 52: *The Cloud Academy* (<https://tinyurl.com/yxr3y9lb>)

Physikmobil, Vienna 2012–2013

Physics outreach campaign

- Explained physics interactively to children (ages 6–14) with experiments using everyday life objects at schools, in public parks and at events

Media Coverage

SWR Aktuell, Südwestdeutscher Rundfunk July 2022

German-language interview for a news segment on JWST first images

Max Planck Society Newsroom July 2022

Quoted in article „The universe in a new dimension” / “Das Universum in einer neuen Dimension” (Published in English & German)

Exocast podcast January 2021

Episode “Exocast-48c: Monthly Exoplanet News” (<https://www.exocast.org/exocast-48c/>)

Science & Vie March 2020

Issue 1231 “Les voyageurs de l’au-delà”, pp. 80-81. Also reprinted in the Chinese edition of Science & Vie.

MITgcm Blog August 2019

Featured paper and interview “Wild and Windy Exoplanets”

(<https://tinyurl.com/windyexoplanets>)

Professional & Departmental Service

Coordinator of the Planetary Agender, Non-binary, Women and Trans Scientists and Staff group (PLANETS-LPL), formerly Lunar and Planetary Laboratory Women’s group 2016–2021

UA Graduate and Professional Student Council Travel Grant Judge 2018-2019

Member of the Lunar and Planetary Laboratory Conference (LPLC) planning committee 2016–2017