

SARAH RUGHEIMER

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CITIZENSHIP USA, Switzerland, UK

RESEARCH INTERESTS I study the climate and atmospheres of habitable exoplanets. My research particularly focuses on the star-planet interaction, studying the effect of UV activity on the atmospheric chemistry and the detectability of biosignatures in a planet's atmosphere with future missions such as JWST/ELT and mission concepts such as Large Interferometer for Exoplanets (LIFE) and NASA's planned Habitable Worlds Observatory.

APPOINTMENTS

Reader (Assoc. Prof), University of Edinburgh **July 2025 - Present**
Chancellor's Fellow

Associate Professor, York University **July 2022 - June 2025**
Research stream faculty in Physics and Astronomy
Allan I. Carswell Chair for the Public Understanding of Astronomy

Glasstone Research Fellow, Oxford University **Oct 2018 - June 2022***
Glasstone Postdoctoral Research Fellowship
Hugh Price Fellowship at Jesus College, Oxford

Simons Research Fellow, St. Andrews University **Oct 2015 - Sept 2018**
Simons Foundation Origins of Life Postdoctoral Research Fellow

Research Associate, Cornell University, Carl Sagan Inst. **Feb 2015 - Aug 2015**

EDUCATION

Harvard University, Cambridge, MA **September 2008 - January 2015***

M.A. in Astronomy *June 2010*

Ph.D. in Astronomy & Astrophysics *June 2010 - January 2015*

- Thesis Title: Hues of Habitability: Characterizing Pale Blue Dots Around Other Stars
- Advisors: Lisa Kaltenegger and Dimitar Sasselov
- Chosen as one of 8 PhD students at Harvard throughout Graduate School Arts and Sciences as a [2014 Harvard Horizons Scholar](#)

* Harvard recognized a 1.5 years delay in time caring for terminally ill father.

University of Calgary, Calgary, Alberta Canada

B.Sc. (First Class Honors), Physics **Sept 2003 - June 2007**

- Graduated top of class in Department of Physics and Astronomy
- Senior Thesis Topic: Uses of Attractive Bose-Einstein in Atom Interferometers
- Undergrad summer research projects: placing quantum dots in phospholipid vesicles as a precursor to tracking active neuron cells with Dr. X.L. Wu (2003); modeling MEG data on brain surfaces generated from MRI data with Dr. Mingui Sun (2005); and numerically modeled Earth-like planets in the habitable zone of the nearby star system of HD 69830 with Dr. Haghhighipour (2006).

Flathead Valley Community College **Sept 2002 - May 2003**

LIST OF GRANT FUNDS	<ul style="list-style-type: none"> ◇ C\$125k as PI - NSERC Discovery Grant ◇ C\$12.5k as PI - NSERC Starting Launch Fellowship ◇ C\$12.5k as co-PI - Lassonde Grant for Interdisciplinary Research ◇ C\$30k as PI - Carswell Public Outreach Funds ◇ C\$100k as co-I Academic Innovation Fund 2023-2024 ◇ £165k as PI - Glasstone Oxford Postdoctoral Research Fellowship ◇ £10k as PI - Hugh Price Fellowship at Jesus College, Oxford ◇ \$250k as PI - Simons Postdoctoral Origins of Life Fellowship
AWARDS	<ul style="list-style-type: none"> ● NSERC Discovery Grant 2022-2027 (Canadian national funding for research group) ● Heising-Simons Scialog SLU Fellow 2023 ● Academic Innovation Fund (AIF) grant co-I to increase access for students with disabilities ● TED 2020 Fellow and talk - 1.7 million views ● Glasstone Oxford Postdoctoral Research Fellowship ● Hugh Price Fellowship at Jesus College, Oxford ● Simons Postdoctoral Origins of Life Fellowship ● BSA Rosalind Franklin Prize in the Physical Sciences and Math 2019 ● Barrie Jones Astrobiology Outreach and Education Award 2019 ● Caroline Herschel Prize Lectureship 2018 ● 2014 Harvard Horizons Scholar ● D.A.A.D Fellowship ● Derek Bok Center Distinction in Teaching Award for <i>The Energetic Universe</i>, Spring 2012, Harvard University ● Venkatesan Silver Medallion, for being the top graduate in my physics class at the University of Calgary in 2007
COMMUNITY INVOLVEMENT & SERVICE	<p>LIFE - Large Interferometer for Exoplanets mission design Core Team Member and co-lead of Project Office (2018 - present)</p> <p>EGU Planetary Science Team Officer (2021 - 2023)</p> <p>Reviewer for NASA's XRP & FINESST, Canada's NSERC, and Germany's DFG grant schemes.</p> <p>Reviewer for the journals: <i>Nature</i>, <i>Nature Scientific Reports</i>, <i>MNRAS</i>, <i>A&A</i>, <i>ApJ</i>, <i>AJ</i>, <i>ApJL</i>, <i>FACETS</i>, <i>MDPI</i>, <i>Astrobiology</i>, and <i>Elements</i></p> <p>Editor for Oxford Research Encyclopedia of Planetary Science at Oxford University Press (2018 - 2021)</p> <p>Co-organizer for Lorentz Exocomet Workshop, May 2019</p> <p>Co-organizer for Lorentz LIFE Workshop, rescheduled for 2022 due to COVID</p> <p>LOC for Exoclines Oxford, Aug 2019</p>
OBSERVING PROPOSALS	<p>Co-I on HST Cycle 22 - The MUSCLES Treasury Survey: Measurements of the Ultraviolet Spectral Characteristics of Low-mass Exoplanetary Systems (PI - Kevin France, ID 13650)</p> <p>Co-I on HST Cycle 25 The Mega-MUSCLES Treasury Survey: Measurements of the Ultraviolet Spectral Characteristics of Low-mass Exoplanetary Systems (PI - Cynthia Froning, ID 15071)</p> <p>Co-I on HST Cycle 25 The M Dwarf UV Spectra Irradiating Nearby Transiting Terrestrial Planets (PI - Zach Berta-Thompson, ID 15264)</p>

Referred Publications

Rugheimer, S., Alei, E., Konrad, B.S., Taysum, B., Grenfell, J. L., Lichtenberg, T., Quanz, S.P., Kitzmann, D., and van der Tak, F. (2026) The Goldilocks problem for detecting water in terrestrial planets: Constraining water abundances in the mid-IR with LIFE, *accepted ApJ*

Taysum, B., **Rugheimer, S.**, Grenfell, J. L., Cabrera, J., Schreier, F., Rauer, H. (2026) Breaking the triple signature: false-positives for oxygenic photosynthesis across the habitable zone, *in review Nature*

*Wang, E., **Rugheimer, S.**, and Dittman, J. (2026) Direct Detection of Silicon Monoxide in the Atmosphere of the Ultra-Hot Jupiter WASP-178b with Archival HST/STIS Near-ultraviolet Spectroscopy. *submitted AJ*

*Student Advised

Grenfell, J.L., Taysum, B., van Zelst, I. Schreier, F., Innes, H., Smith, A.M.S., Csizmadial, S. Irol, N., **Rugheimer, S.**, Kozakis, T., Alei, E., Noack, L., Lichtenberg, T., Quanz, S., Herbst, K., Sinnhuber, M., Bartenschlager, A., Cabrerall, J., and Rauer, H. (2025) Detectability of Atmospheric Climate and Biosignatures with the Large Interferometer for Exoplanets (LIFE) for terrestrial-type Exoplanets. *MNRAS*, staf1878. doi.org/10.1093/mnras/staf1878

Cote, P., Woods, T., Hutchings, J. et al. (2025) The CASTOR mission, *SPIE Journal of Astronomical Telescopes, Instruments, and Systems JATIS*, 11, 4, 042202. doi.org/10.1117/1.JATIS.11.4.042202

Braam, M., Palmer, P.I., Decin, L., Mayne, N.J., Manners, J., and **Rugheimer, S.** (2025) Earth-like exoplanets in spin-orbit resonances: climate dynamics, 3D atmospheric chemistry, and observational signatures, *Planet. Sci. J.* 6, 5. doi.org/10.3847/PSJ/ad9565

Wilson, D. J., Froning, C. S., Duvvuri, G. M., Youngblood, A., France, K., Brown, A., Berta-Thompson, Z., Schneider, P. C., Buccino, A. P., Linsky, J., Loyd, R. O. P., Miguel, Y., Newton, E., Pineda, J. S., Redfield, S., Roberge, A., Rugheimer, S., Vieytes, M. C. (2024) The Mega-MUSCLES Treasury Survey: X-ray to infrared Spectral Energy Distributions of a representative sample of M dwarfs. *ApJ* 978, 85. [doi:10.3847/1538-4357/ad9251](https://doi.org/10.3847/1538-4357/ad9251)

Glauser, A. M. et al., (2024) The Large Interferometer For Exoplanets (LIFE): a space mission for mid-infrared nulling interferometry, Proc. SPIE 13095, Optical and Infrared Interferometry and Imaging IX, 130951D. [doi:10.1117/12.3019090](https://doi.org/10.1117/12.3019090).

Cesario et al. 2024. LIFE XIV. Finding Terrestrial Protoplanets in the Galactic Neighbourhood. *A&A* 692, A172. [doi:10.1051/0004-6361/202450764](https://doi.org/10.1051/0004-6361/202450764)

Alei, E., Quanz, S.P., Konrad, B.S., Garvin, E.O., Kofman, V., Mandell, A., Angerhausen, D., Molliere, P., Meyer, M., Robinson, T., **Rugheimer, S.** and the LIFE Collaboration. (2024) Large Interferometer For Exoplanets (LIFE): XIII. The Value of Combining Thermal Emission and Reflected Light for the Characterization of Earth Twins. *A&A* 689, A245. [doi:10.1051/0004-6361/202450320](https://doi.org/10.1051/0004-6361/202450320)

*Claringbold, A., Rimmer, P., **Rugheimer, S.**, and Shorttle, O. (2023) Prebiosignature Molecules Can Be Detected in Habitable Exoplanet Atmospheres with JWST. *AJ*, 166, 39. [10.3847/1538-3881/acdacc](https://doi.org/10.3847/1538-3881/acdacc)

*Student Co-advised

Cooke, G.J., Marsh, D.R., Walsh, C., S **Rugheimer, S.**, and Villanueva, G.L. (2022) Variability due to climate and chemistry in observations of oxygenated Earth-analogue exoplanets. *MNRAS*, stac2604. [doi:10.1093/mnras/stac2604](https://doi.org/10.1093/mnras/stac2604)

Konrad, B.,S., Alei, E., Quanz, S. P., Mollière, P., Angerhausen, D., Fortney, J., Hakim, K., Jordan, S., Kitzmann, D., **Rugheimer, S.**, Shorttle, O., Wordsworth, R., and the LIFE Collaboration (2023) Large Interferometer For Exoplanets (LIFE) IX. Assessing the impact of clouds on atmospheric retrievals at mid-infrared wavelengths with a Venus-twin exoplanet. *A&A* 673, A94, 29. [doi:10.1051/0004-6361/202245655](https://doi.org/10.1051/0004-6361/202245655)

Alei, E., Konrad, B.S., Angerhausen, D. Grenfell, J.L., Mollière, P., Quanz, S.P., **Rugheimer, S.**, Fabian Wunderlich, and the LIFE Collaboration (2022) Large Interferometer For Exoplanets (LIFE) V. Diagnostic potential of a mid-infrared space interferometer for studying Earth analogs. *A&A*, 665, A106. [doi:10.1051/0004-6361/202243760](https://doi.org/10.1051/0004-6361/202243760)

Konrad BS, Alei E, Quanz SP, Angerhausen D, Carrión-González Ó, Fortney JJ, Grenfell JL, Kitzmann D, Mollière P, Rugheimer S, Wunderlich F. (2022) Large Interferometer For Exoplanets (LIFE)-III. Spectral resolution, wavelength range, and sensitivity requirements based on atmospheric retrieval analyses of an exo-Earth. *A & A*. 664:A23. [doi:10.1051/0004-6361/202141964](https://doi.org/10.1051/0004-6361/202141964)

LIFE Collaboration, Quanz, S. et al. including **S. Rugheimer** (2021) Large Interferometer For Exoplanets (LIFE): I. Improved exoplanet detection yield estimates for a large mid-infrared space-interferometer mission. *A&A* 664, A21 (2022), [doi:10.1051/0004-6361/202140366](https://doi.org/10.1051/0004-6361/202140366)

Gialluca, M., Robinson, T, **Rugheimer, S.**, Wunderlich, F. (2021) Characterizing Atmospheres of Transiting Earth-like Exoplanets Orbiting M Dwarfs with James Webb Space Telescope, *PASP* 133 054401 [doi:10.1088/1538-3873/abf367](https://doi.org/10.1088/1538-3873/abf367)

*Gregory, B., Claire, M., and **Rugheimer, S.** (2021) Photochemical modelling of atmospheric oxygen levels suggests two stable states. *EPSL*, 561, 116818. [doi:10.1016/j.epsl.2021.116818](https://doi.org/10.1016/j.epsl.2021.116818)

*Student Advised

Rimmer, P., Ranjan, S., and **Rugheimer, S.** (2021) Life's Origin and the Search for Life on Rocky Exoplanets. *Elements*, 17, 4.

LIFE Collaboration, Quanz, S. et al. including **S. Rugheimer** (2021) Atmospheric characterization of terrestrial exoplanets in the midinfrared: biosignatures, habitability, and diversity. *Experimental Astronomy* [doi:10.1007/s10686-021-09791-z](https://doi.org/10.1007/s10686-021-09791-z)

Duvvuri, G.M., Pineda, J.S., Berta-Thompson, Z.K., Brown, A., France, K., Kowalski, A.F., Redfield, S., Tilipman, D., Vieytes, M.C., Wilson, D.J., Youngblood, A., Froning, C., Linsky, J., Loyd, R.O.P., Mauas, P., Miguel, Y., Newton, E.R., **Rugheimer, S.**, and Schneider, P.C. (2021) Reconstructing the Extreme Ultraviolet Emission of Cool Dwarfs Using Differential Emission Measure Polynomials. *ApJ*. 913:40. [doi:10.3847/1538-4357/abeaaf](https://doi.org/10.3847/1538-4357/abeaaf)

Wilson, D.J., Froning, C.S., Duvvuri, G.M., France, K., Youngblood, A., Schneider, C.P., Berta-Thompson, Z., Brown, A., Buccino, A.P., Hawley, S., Irwin, J., Kaltnecker, L., Kowalski, A., Linsky, J., Loyd, R.O.P., Miguel, Y., Pineda, J.S., Redfield, S., Roberg, A., **Rugheimer, S.**, Tian, F., and Vieytes, M. (2021) The Mega-MUSCLES Spectral Energy Distribution of TRAPPIST-1, *ApJ* 911:18. [doi:10.3847/1538-4357/abe771](https://doi.org/10.3847/1538-4357/abe771)

Frohman EM, Villemarette-Pittman NR, Rodriguez A, Glanzman R, Rugheimer S, Komogortsev O, Zamvil SS, Cruz RA, Varkey TC, Frohman AN, Frohman AR. (2021) Application of an evidence-based, out-patient treatment strategy for COVID-19: Multidisciplinary medical practice principles to prevent severe disease. *Journal of the neurological sciences*. 426:117463.

Kaltenegger, L., Lin, Z., **Rugheimer, S.** (2020) Finding signs of life on transiting earth-like planets: high-resolution transmission spectra of earth through time around FGKM host stars. *ApJ*, 904:10. doi:10.3847/1538-4357/abb9b2

Stüeken, E., Som, S.M., Claire, M., **Rugheimer, S.**, Sherf, M., Sproß, L., Tosi, N., Ueno, Y., and Lammer, H. (2020) Mission to planet earth: the first two billion years, *Space Sci Rev*, 216:31, doi:10.1007/s11214-020-00652-3

Melbourne, K., Youngblood, A., France, K., Froning, C.S., Pineda, J.S., Shkolnik, E.L., Wilson, D.J., Wood, B.E., Basu, S., Roberge, A., Schlieder, J.E., Cauley, P.W., Loyd, R.O.P., Newton, E.R., Schneider, A., Arulanantham, N., Berta-Thompson, Z., Brown, A., Buccino, A.P., Kempton, E., Linsky, J., Logsdon, S.E., Mauas, P., Pagano, I., Peacock, S., Redfield, S., **Rugheimer, S.**, Schneider, P.C., Teal, D.J., Tian, F., Tilipman, D., and Vieytes, M. (2020) Estimating the Ultraviolet Emission of M dwarfs with Exoplanets from Ca II and H-alpha. *AJ*, 160: 6. doi:10.3847/1538-3881/abfb5c

Linsky, J.L., Wood, B.E., Youngblood, A., Brown, A., Froning, C.S., France, K., Buccino, A.P., Cranmer, S.R., Mauas, P., Miguel, Y., Pineda, S., **Rugheimer, S.**, Vieytes, M., Wheatley, P.J., Wilson, D.J. (2020) The relative emission from chromospheres and coronae: dependence on spectral type and age. *ApJ*, 902:1. doi:10.3847/1538-4357/abb36f

Dandouras, I., Blanc, M., Fossati, L., Gerasimov, M., Guenther, E.W., Kislyakova, K.G., Lammer, H., Lin, Y., Marty, B., Mazelle, C., **Rugheimer, S.**, Scherf, M., Sotin, C., Sproß, L., Tachibana, S., Wurz, P., Yamauchi, M. (2020) Future Missions related to the determination of the elemental and isotopic composition of Earth, Moon and the terrestrial planets. *Space Science Reviews*, 216, 121. doi:10.1007/s11214-020-00736-0t

France, K., Duvvuri, G., Egan, H., Koskinen, T., Wilson, D.J., Youngblood, A., Froning, C.S., Brown, A., Alvarado-Gomez, J.D., Berta-Thompson, Z.K., Drake, J.J., Garraffo, C., Kaltenegger, L., Kowalski, A.F., Linsky, J.F., Loyd, R.O.P., Mauas, P.J.D., Miguel, Y., Pineda, J.S., **Rugheimer, S.** Schneider, P.C., Tian, F., and Vieytes, M. (2020) The High-Energy Radiation Environment Around a 10 Gyr M Dwarf: Habitable at Last? *AJ*. 160, 5. doi:10.3847/1538-3881/abb465

Kaltenegger, L., Madden, J., Lin, Z., **Rugheimer, S.**, Segura, A., Luque, R., Palle, E., and Espinoza, N. (2019) The Habitability of GJ 357 d: Possible Climates and Observability. *ApJL* 883:L40. doi:10.3847/2041-8213/ab3d40

Rimmer, P. & **Rugheimer, S.** (2019) Hydrogen Cyanide in Nitrogen-Rich Atmospheres of Rocky Exoplanets. *Icarus*, 329: 124-131. doi:10.1016/j.icarus.2019.02.020

Rimmer, P., Shorttle, O., & **Rugheimer, S.** (2019) Oxidised Micrometeorites are Evidence for Low Atmospheric Pressure on the Early Earth. *Geochemical perspective letters*, 9: 38-42. doi:10.7185/geochemlet.1903

*Kawashima, Y. & **Rugheimer, S.** (2019) Theoretical Reflectance Spectra of Earth-Twins Through Their Evolutions: Impact of Clouds and Detectability of O₂, H₂O, and CH₄ with LUVOIR Telescope. *AJ*, 157:5. doi:10.3847/1538-3881/ab14e3

*Student Advised

Froning, C., Kowalski, A., France, K., Loyd, R.O.P., Schneider, C., Youngblood, A., Wilson, D., Brown, A., Berta-Thompson, Z., Pineada, J.S., Linsky, J., **Rugheimer, S.** and Miguel, Y. (2019) A Hot Ultraviolet Flare on the M Dwarf Star GJ 674, *ApJL*, 871(2):L26. doi:10.3847/2041-8213/aaffcd

Rugheimer, S. and Kaltenegger, L. (2018) Spectra of Earth-like Planets Orbiting FGKM Stars Through Geological Evolution, *ApJ*, 854:19. doi:10.3847/1538-4357/aaa47a

Airapetian, V.S. et al. and 46 co-authors including **Rugheimer, S.** (2019) Impact of Space Weather on Climate and Habitability of Terrestrial Type Exoplanets, *International Journal of Astrobiology* 1-59. doi:10.1017/S1473550419000132

Schwieterman, E.W., Kiang, N.Y., Parenteau, M.N., Harman, C.E., DasSarma, S., Fisher, T.M., Arney, G.N., Hartnett, H.E., Reinhard, C.T., Olson, S.L., Meadows, V.S., Cockell, C.S., Walker, S.I., Grenfell, J.L., Hegde, S., **Rugheimer, S.**, Hu, R., Lyons, T.W. (2018) Exoplanet Biosignatures: A Review of Remotely Detectable Signs of Life, *Astrobiology* 18(6), 663-708. doi:10.1089/ast.2017.1729

Blumenthal, S.D., Mandell, A.M., Hebrard, E., Batalha, N.E., Cubillos, P.E., **Rugheimer, S.**, Wakeford, H.R. (2018) A Comparison of JWST Spectra from Equilibrium & Disequilibrium Chemistry Models in Gaseous Planets. *ApJ* 853, 138. doi:10.3847/1538-4357/aa9e51

Loyd, R.O.P., France, K., Youngblood, A., Schneider, C., Brown, A., Hu, R., Segura, A., Linsky, J., Redfield, S., Tian, F., **Rugheimer, S.**, Miguel, Y., Froning, C. (2018) The MUSCLES Treasury Survey V: FUV Flares on Active and Inactive M Dwarfs. *ApJ* 867:71. doi:10.3847/1538-4357/aae2bd

Youngblood, A., France, K., Loyd, R.O.P., Brown, A., Mason, J.P., Schneider, P.C., Tilley, M.A., Berta-Thompson, Z.K., Buccino, A., Froning, C.S., Hawley, S.L., Linsky, J., Mauas, P.J.D., Redfield, S., Kowalski, A., Miguel, Y., Newton, E.R., **Rugheimer, S.**, Segura, A., Roberge, A., and Vieytes, M. (2017) The MUSCLES Treasury Survey IV: Scaling Relations for Ultraviolet, Ca II K, and Energetic Particle Fluxes from M Dwarfs. *ApJ*. 843: 31. doi:10.3847/1538-4357/aa76dd

Domagal-Goldman Shawn D., Wright Katherine E., & 47 co-authors including **Rugheimer, S.**, (2016) Astrobiology Primer 2.0, *Astrobiology* 16: 8, 561-653. doi:10.1089/ast.2015.1460

France, K., Loyd, R.O.P., Youngblood, A., Brown, A., Schneider, P.C., Hawley, S.L., Froning, C.S., Linsky, J.L., Roberge, A., Buccino, A.P., Davenport, J., Fontenla, J.M., Kaltenegger, L., Kowalski, A.K., Mauas, P., Miguel, Y., Redfield, S., **Rugheimer, S.**, Tian, F., Vieytes, M.C., Walkowicz, L.M., and Weisenburger, K.L. (2016) The MUSCLES Treasury Survey I: Motivation and Overview, *ApJ*, 820: 2, 89. doi:10.3847/0004-637X/820/2/89

Youngblood, A., France, K., Loyd, R.O.P., Linsky, J.L., Redfield, S., Schneider, P.C., Wood, B.E., Brown, A., Froning, C., Miguel, Y., **Rugheimer, S.**, and Walkowicz, L. (2016) The MUSCLES Treasury Survey II: Intrinsic Lyman Alpha and Extreme Ultraviolet Spectra of K and M Dwarfs with Exoplanets, *ApJ*. 824: 2, 101. doi:10.3847/0004-637X/824/2/101

Loyd, R.O.P., France, K., Youngblood, A., Schneider, C., Brown, A., Hu, R., Linsky, J., Froning, C.S., Redfield, S., **Rugheimer, S.**, and Tian, F. (2016) The MUSCLES

Treasury Survey III: X-Ray to Infrared Spectra of 11 M and K Stars Hosting Planets, *ApJ*. 824: 2, 102. doi:10.3847/0004-637X/824/2/102

Rugheimer, S., Kaltenecker, L., Segura, A., Linsky, J. and Mohanty, S. (2015) Influence of UV activity on the Spectral Fingerprints of Earth-like Planets around M dwarfs. *ApJ*. 809:57. doi:10.1088/0004-637X/809/1/57

Rugheimer, S., Segura, A., Kaltenecker, L., Sasselov, D. (2015) Surface UV fluxes for Earth-like planets around FGKM stars. *ApJ*. 806:137. doi:10.1088/0004-637X/806/1/137

Miguel, Y., Kaltenecker, L., Linsky, J. and **Rugheimer, S.** (2015) The Effect of Lyman alpha Radiation on Mini-Neptune Atmospheres Around M Stars: Application to GJ 436b. *MNRAS*. 446: 345-353. doi:10.1093/mnras/stu2107

Kaltenecker, L., Sasselov, D. and **Rugheimer, S.** (2013) Water Planets in the Habitable Zone: Atmospheric Chemistry, Observable Features, and the case of Kepler-62e and -62f. *ApJL*. 775: L47. doi:10.1088/2041-8205/775/2/L47

Rugheimer, S., Kaltenecker, L., Zsom, A., Segura, A., Sasselov, D., (2013) Spectral Fingerprints of Earth-like Planets around FGK Stars. *Astrobiology*. March 2013, 13(3): 251-269. doi:10.1089/ast.2012.0888

Kaltenecker, L., Miguel, Y. and **Rugheimer, S.**, (2012) Rocky exoplanet characterization and atmospheres. *International Journal of Astrobiology* 11(04): 297-307.

WHITE PAPERS

Rugheimer, S., Weatherbee, A., Fecanin, J. et al. (2025) Detecting habitable exoplanet atmospheres with LIFE, the Large Interferometer for Exoplanets. *UKSA White Paper Call*

Exoplanet characterization with NASA's Habitable Worlds Observatory (thematic area: Astro) Barstow, J., Biller, B., Mak, M.T., **Rugheimer, S.**, Triaud, A., and Wakeford, H.R. *UKSA White Paper Call*

Biller, B., Dicken, D., Absil, O., Artan, R., Barstow, J., Birkby, J., Dumas, C., Hinkley, S. Komacek, T., Morris, K., Pino, L., **Rugheimer, S.**, Snodgrass, C., Todd, S., Thuraiethinam, V., Triaud, A. (2025) The Key to Unlocking Exoplanet Biosignatures: a UK-led IR Spectrograph for the Habitable Worlds Observatory Coronagraph. *UKSA White Paper Call*

Quanz et al., S and 47 co-authors including **Rugheimer, S.** (2019) Atmospheric characterization of terrestrial exoplanets in the mid-infrared: biosignatures, habitability & diversity *White paper for the Voyage 2050 long-term plan in the ESA Science Programme* arXiv:1908.0131

Fortney, J. et al. and 86 co-authors including **Rugheimer, S.** (2019) The Need for Laboratory Measurements and Ab Initio Studies to Aid Understanding of Exoplanetary Atmospheres. *Astro2020 Science White Paper*, arXiv:1905.07064

Parry, I. and 22 co-authors including **Rugheimer, S.** (2018) SUPERSHARP - Segmented Unfolding Primary for Exoplanet Research via Spectroscopic High Angular Resolution Photography. arXiv:1801.06111

Domagal-Goldman, S. and 40 co-authors including **Rugheimer, S.** (2018) Life Beyond the Solar System: Remotely Detectable Biosignatures. This is a white paper

that was submitted to the National Academies of Sciences Study: Astrobiology Science Strategy for the Search for Life in the Universe. [arXiv:1801.06714](https://arxiv.org/abs/1801.06714)

Airapetian, V. S. , Danchi, W. C.1, Dong, C. F.3, **Rugheimer, S.** and 32 co-authors (2018) Life Beyond the Solar System: Space Weather and Its Impact on Habitable Worlds. Submitted to the National Academy of Sciences in support of the Astrobiology Science Strategy for the Search for Life in the Universe. [arXiv:1801.07333](https://arxiv.org/abs/1801.07333)

TEACHING

Course Head:

York University, Toronto, ON, Canada

- **PHYS 1470 - Highlights of Astronomy** **Spring/Fall 2023 & 2024**
First year astronomy course for engineering students (calculus pre-requisite)

Teaching evaluations for Spring 2023:

- “General quality of the lecturer as a whole” 5.0 average out of 5.
- “Lecturer covered the material at an appropriate intellectual level - neither too complicated nor too simple” 4.5 average out of 5
- 100% of the students in the course evaluations answered yes to “Do you think your instructor should be nominated for a teaching award?”

- **PHYS 3070 - Planets and Planetary Systems** **Fall 2023, 2024**
Third year astrophysics majors course

University of St. Andrews, St. Andrews, Scotland, UK

- **Astrobiology: The Search for Life in the Universe Spring 2017**
I designed and led a new first year interdisciplinary module with over 100 students and was one of the highest enrolled courses at the University.
- **Environmental Geochemistry, ES 5010** **Spring 2016**
Designed and led module “Mineral evolution through geological history” for a 4th year geology course

Tufts University, Medford, MA USA

- **Life on Earth and Beyond** **Fall 2013**
 - Visiting Lecturer to create and teach a new laboratory and lecture astrobiology course
 - Course filled to maximum capacity within 1 hour of registration opening.
 - Nominated by graduating senior in 2016 for being one of the “most impactful to your intellectual and personal development while at Tufts”
 - Complete course evals: http://www.sarahrugheimer.com/EXP022_Eval.pdf

Teaching Assistant:

Harvard University, Cambridge, MA USA

Teaching Fellow for following courses:

- **The Energetic Universe** **Spring 2012**
 - An introductory Astronomy course for non-majors taught by Bob Kirshner.
 - Received Harvard’s Distinction in Teaching Award
- **Stellar and Planetary Astrophysics** **Fall 2010**
 - A graduate level Astronomy course taught by Dimitar Sasselov.
- **Life as a Planetary Phenomenon** **Spring 2010**

- An introductory Astrobiology course for non-majors taught by Dimitar Sasselov.

Teaching and Pedagogy Training:

- ◇ Completed AAS Centre for Astronomy Education Course on Active Learning
- ◇ Completed Harvard's Bok Center Teaching Certificate
- ◇ Harvard University's "Scientists Teaching Science" hands-on course on active learning and effective science education with Professor Philip Sadler
- ◇ Harvard University's Bok Center Course "Problems with the Blackboard: Tools for Teaching Science & Math" with John Girash
- ◇ Harvard University's Finding Your Voice workshop on effective presentations.

RESEARCH ADVISING EXPERIENCE

University of Edinburgh, Edinburgh, UK

- **Advising PhD student James Fecanin** **Sept 2025 - current**
Thesis: "Modeling the exotic worlds of exoTitans around other stars"
- **Advising MSc student Renzo Croese** **Sept 2025 - current**
Thesis: "Detecting molecules in hot Jupiter archival HST data"

York University, Toronto, Canada

- **Advising MSc/PhD student June Parsons** **Sept 2023 - current**
Thesis: "Habitability of Brown Dwarfs"
- **Advising bachelors MSc Aiden Weatherbee** **Sept 2025 - current**
Thesis: "Derisking the LIFE Mission: End-to-End GNC Verification and Yield Analysis for the Mini-X Precursor"
- **Advising MSc student Esther Wang** **Sept 2023 - Aug 2025**
Thesis: "Detecting SiO with updated ExoMol UV linelists in hot Jupiter archival HST data"
- **Advising bachelors student Camila Guzman** **May 2025 - Sept 2025**
Topic: "Setting up the spectrograph on 1 m Allan I Carswell Observatory for RV observations"
- **Advising bachelors student Aiden Weatherbee** **Jan 2024 - Aug 2025**
Topic: "Building a pipeline for transiting exoplanets with the 1 m Allan I Carswell Observatory"
Topic: "Image processing of JWST data with PixInsight and Siril"
- **Advising bachelors student Boris Ciric** **Sept 2023 - May 2024**
Topic: "VPLANET"
- **Advising bachelors student Mark Vertlib** **Nov 2022 - May 2024**
Topic: "False Positives in atmospheres without a cold trap"
- **Advising bachelors student Leith Arnold** **Nov 2022 - May 2023**
Topic: "1D convective cloud modeling"
- **Advising bachelors student Joshua Parsons** **Nov 2022 - May 2023**
Thesis: "Habitability of Brown Dwarfs"

University of Oxford, Oxford, UK

- **Co-advising MSc student Alastair Claringbold** **Sept 2021 - June 2022**
Thesis: "Prebiosignatures: Detecting the Origin of Life."
- **Co-advising PhD student Tyler Murray-Ramcharan** **Sept 2021 - current**
Thesis: Ecology and astrobiology

- **Pastoral advisor PhD student RJ Graham** **Oct 2018 - June 2022**
Thesis: “Silicate Weathering Feedback & its Influence on Rocky Planet Climate”
- **Pastoral advisor PhD student Jinzhao Sun** **Oct 2018 - June 2022**
Thesis: “Coupling of magnetic order and charge transport in the europium topological semimetal candidates”

University of St. Andrews, St Andrews, UK

- **Co-advised PhD student Bethan Gregory** **Sept 2016 - June 2021**
Thesis: “Development of a 1-D oxygen isotope photochemical model and its application to atmospheric O₂”, viva passed Dec 2020, thesis accepted March 2021.

Kavli Exoplanet Atmospheres Summer Program, UC Santa Cruz, CA

- **Advised graduate student Yui Kawashima** **Summer 2016**
Project: “Impact of clouds on detecting oxygen with LUVUOIR” paper published
- **Advised postdoc Dr. Liu Hui-Gen** **Summer 2016**
Project: “TRAPPIST-1 and Assessing the Habitability of Ultra-cool Dwarfs”

Public Engagement

At York University, I hold the Allan I. Carswell Chair for the Public Understanding of Astronomy. This is a joint research group leader and outreach faculty position with a course release of teaching.

In 2020, I wrote and recorded a 10 lecture series for *The Teaching Company* partnered with *Amazon Audible Originals* called “[Searching for Extraterrestrial life](#)”. Currently, I am writing a *Wondrium* course partnered with *The Great Courses* called “[Experiencing James Webb: The Invisible Universe Revealed](#).”

I’ve given over 120 interviews in TV, radio, press, and public talks in my role to engage the Canadian public in Astronomy, and previously had given interviews for the BBC and NPR (National Public Radio).

SELECTED
INTERVIEWS AND
PRESS

- ◇ TV interview at [Breakfast TV Toronto about DART](#)
- ◇ Documentary Review I wrote for *Science*: [The Hunt for Planet B](#)
- ◇ The August Feature I wrote for *New Scientist*: [Is There Anybody Out There?](#)
- ◇ Newstalk 1010: [If aliens contact humanity, who decides what we do next?](#)
- ◇ BBC Radio 4 Inside Science: [Understanding Biosignatures](#)
- ◇ BBC Radio 4 [The Curious Cases of Rutherford and Fry](#)

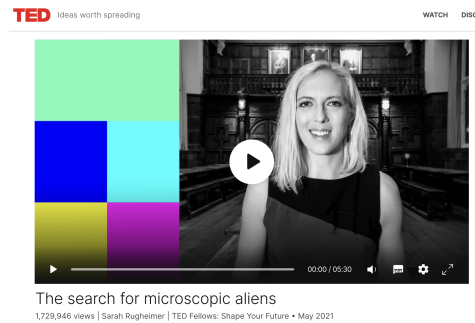
Selected press coverage and interviews about my research:

[Interview on my podcast and TED fellowship from University of Calgary](#)
[British Science Festival Lecture Summary: Are we alone in the Universe?](#)
[Are We Alone? British Science Association Rosalind Franklin Prize Interview](#)
[Phys.org - Earth holds the key to detecting life beyond our solar system](#)
[Planetary.org - Creating a guidebook for Earth’s hypothetical twin](#)
[Cornell - Astronomers create array of Earth planet models](#)
[Daily Mail UK - Computer models reveal how Earth-like Planets Evolve in Time](#)
[Harvard Gazette - Doctoral student focuses on atmosphere in search for exolife](#)
[Flathead Beacon - Looking for life beyond our own](#)

TED

I was a 2020 TED Fellow and gave a remote mainstage TED talk due to COVID with now over **1.7 million views** called “[The Search for Microscopic Aliens](#).”

The TED Fellows Program is a highly competitive program for junior academics, artists, and entrepreneurs that the TED selection committee believes have shown unusual accomplishment in their respective disciplines and for their future impact potential. Here is an [overview of the TED fellowship and the announcement](#) of the 2020 TED Fellows.



PUBLIC
OUTREACH

Through GeoBus, I've led workshops on Mars exploration and scientific literacy, and created a [youtube video on biosignatures](#) in a minute. This video was chosen as for the Goldschmidt 2017 Wild Orbit Film Festival.

I am interested in science and education policy and how scientists can better communicate our findings to the public. With two other graduate students I launched PolicyLab.org in 2013 as an outlet for Harvard science graduate students where I served as senior editor the communications director.

I have also spoken [on live radio at Boston's National Public Radio \(NPR\)](#) about finding Earth-like planets and biosignatures, and was on a [panel at MIT](#) to discuss the science behind the movie *Interstellar*. At the Edinburgh Science Festival, I was on a panel about the ethics of detecting and potentially interacting with alien life. At SETI, I gave a talk "Why is Earth Still Habitable?"

RESEARCH
PRESENTATIONS

Selected Invited Oral

- University of Edinburgh Colloquium,
- LCLU Cambridge University Origins Seminar, 16 Oct 2025
- Trouble Club London, 16 Oct 2025
- JWST image processing Discovery Session, TED Vancouver, 8 April 2025
- Cornell Colloquium, 20 March 2025
- Ottawa Colloquium, 11 Feb 2025
- McGill CAP Lecture Tour 14 Feb 2025
- UNICID - Universidade Cidade de São Paulo, Brazil Colloquium 13 May 2024
- University of Toronto, Missauga Colloquium 14 Feb 2025
- CITA, Canadian Institute for Theoretical Astrophysics Colloquium 11 Feb 2025
- University of Boulder Colloquium 22 January 2024
- Harvard Colloquium, 14 Feb 2023
- McMaster University Colloquium, 7 Dec 2022
- Univ de Montréal Colloquium, 1 Dec 2022
- Peter Sim Memorial Lecture, RASC Calgary, 23 Oct 2022
- Keynote on Planetary Habitability, PFE-SPP 1992, Berlin, 12 Sept 2022
- Plenary talk at Brazilian Astrobiology Annual Meeting, 30 Nov 2021
- McMaster University colloquium, 17 June 2021
- Stanford Colloquium, 30 March 2021
- University of Amsterdam Colloquium, 18 March 2021
- University of Belfast colloquium, 28 Oct 2020
- *Detecting Pre-biosignatures: Failed biosphere or planet ready for life?* Antibiosignatures U Chicago conference 27 May 2020
- University of Florida colloquium, 13 Feb 2020
- Barrie Jones Award Lecture, 6 Dec 2019
- BSA Rosalind Franklin Prize Lectureship, 10 Sept 2019
- ETH Zurich Earth Sciences colloquium, 1 Oct 2019
- Northwestern colloquium, 12 April 2019
- University of Cambridge colloquium, 5 Feb 2019
- University of Heidelberg colloquium, 5 Dec 2018
- Royal Astronomical Society and Royal Geological Society, London, 20 Nov 2018
- Caroline Herschel Lecture, Herschel Society, Bath, 21 Nov 2018

- *Biosignatures, Atmospheres, & Implications for Life* ISSI, Bern, Oct 2018
- *UV, Biosignatures, and Life* Columbia University, colloquium, 18 April 2018
- *UV, Biosignatures, and Life* NYU - Abu Dhabi, colloquium, 8 Oct 2017
- *UV, Biosignatures, and Life* Climate Science, Atmospheres and Life: From the Earth and Beyond, University of Cambridge, 17 May 2017
- *How to Detect Life on Another Planet*, Next in Science, Radcliffe Institute for Advanced Study, Harvard, 14 Oct 2016
- *Terrestrial exoplanets under M dwarf Irradiation*, Opportunity M, Harvard, 2016
- *A Review of Biosignatures*, NExSS, 27 June 2016
- *Characterizing Pale Blue Dots Around FGKM Stars*, AGU, Dec 2015

Selected Contributed Oral

- *Triple signature false positive biosignatures & boundary conditions*, AAS Exoplanet Atmospheres, Denver 20 Mar 2026
- *Detecting Oceans with LIFE*, LIFE Barcelona, 12 Nov 2025
- *Biosignatures Through Rocky Planet Evolution Around Other Stars*, LATSIS ETH Zurich, 1 Sept 2022
- *Detecting Pre-Biosignatures in the atmospheres of Earth-like planets around M and G stars*, British Planetary Society Conference, 13 Jan 2020
- *Detecting Biosignatures and Pre-Biosignatures in the Atmospheres of Earth-like Planets Around Other Stars with High Resolution Spectroscopy*, HoRSE - High Resolution Spectroscopy for Exoplanet Atmospheres, Nice France, Oct 2018
- *Prebiotic Signatures and Geological Progression of Biosignatures* ESO Diversis Mundi: The Solar System in an Exoplanetary context (OPSIII), Chile, Mar 2018
- *Remote Detectability of Oxygen through Geological Time around FGKM Stars*, AbSciCon, Phoenix, 24 April 2017
- *Using the PandExo JWST Simulator*, UK EXOM, St. Andrews, UK, March 2017
- *Importance of UV in Characterizing Pale Blue Dots Around FGKM Stars*, Extreme Solar Systems III - Kona, Hawaii, Dec 2015
- *UV Surface Environments of Earth-like Planets Orbiting FGKM Stars Through Geological Evolution*, AbSciCon - Chicago, IL, June 2015
- *Characterizing Pale Blue Dots Around Other Stars*, AAS Dissertation Talk - Seattle, WA, January 2015
- *Influence of UV activity on the Spectral Fingerprints of Earth-like Planets around M dwarfs*, EBI - Search for Life Beyond the Solar System - Tuscon, AZ, Mar 2014
- *Influence of UV activity on the Spectral Fingerprints of Earth-like Planets around M dwarfs*, MPIA - Heidelberg, Germany, Mar 2014
- *Comparison of Transit Spectra of the First Small Exoplanets in the HZ Kepler 62 e & f*, Division for Planetary Sciences - DPS - Denver, Oct 2013
- *Cosmic Habitability*, AbGradCon, Sweden, June 2010

GENERAL
MENTORING
&
WOMEN IN
STEM

Impostor Syndrome and Mental Health Advocacy

I have a strong interest in promoting mental health and well-being for students and faculty. My most commonly requested workshops when I visit a University for a colloquium is my workshop on the *Impostor Syndrome*. More recently, I've been getting increasing requests for my seminar on *Mental Health*. I have given these workshops at UC Santa Cruz, Columbia, University of St. Andrews, Oxford University, University of Leiden, University of Bern and Geneva (PlanetS junior researchers retreat), and Harvard University.

As part of this advocacy for mental health, I co-host a podcast with Dr. Sarah Ballard called "[Self-care with Drs. Sarah](#)" where we discuss techniques for productivity, mental health, and successfully managing the pressures of academia to bring your full engagement to science in a sustainable way.

Public Speaking Training for Students

I also have run several successful public speaking workshops for students from a performance art perspective, as that is an area that causes a lot of stress in the journey of going from a student to a colleague. I personally used to be a horrible public speaker, turning bright red and shaking, and by sharing that journey with students they come to see public speaking as a skill and not a trait.

Women in STEM, rural student outreach, and general mentoring

For my work to promote women in STEM, I was on the Equality and Diversity Committee at St. Andrews and helped launch WISSA - Women in Science at St. Andrews and served as our School's representative. I have mentored several graduate women students at Harvard and at St. Andrews, and through Harvard Graduate Woman in Science and Engineering (HGWISE) for a female undergraduate student. I also served as a HGWISE board member from 2011 to 2013.

I have a particular interest in rural outreach of science, coming from a small town in Montana myself. I volunteered for a geoscience outreach to rural Scottish secondary schools called GeoBus. One of my proudest moments was encouraging a young woman in Montana to apply to Harvard for her PhD - when she felt she didn't belong coming from a town in the mountains and a local college for her bachelors to apply to an Ivy League University for graduate school. Eight years later she has her PhD from Harvard and is now a professor back in Montana!

For general student mentoring, I was the pastoral supervisor for two D.Phil students at Oxford in the Physics department. From 2009-2013, I served a graduate representative on the Committee for Academic Studies which monitored the progress of all Harvard astronomy graduate students and advocated for student concerns.

INTERESTS AND RANDOM FUN FACTS

I love high altitude and glacier mountaineering and have climbed e.g. Denali (20,310', 6190m), Cayambe (18,996' / 5790m), Chimborazo - Veintimilla (20,440' / 6230m), Mt. Rainier (14,410' / 4392 m), Mt. Kilimanjaro (19,341' / 5895 m), and Aconcagua (22,841' / 6962 m). I also competed internationally in Irish Dance for 11 years.

ACADEMIC REFERENCES

Prof. Pat Hall phall@yorku.ca
Dept Chair, Physics and Astronomy, York University

Prof. Sascha Quanz sascha.quanz@phys.ethz.ch
Professor in Physics Dept at ETH Zürich & PI of LIFE collaboration

Prof. Tony Prave ap13@st-andrews.ac.uk
Head of School Earth & Environmental Sciences, University of St. Andrews

Prof. Dimitar Sasselov dsasselov@cfa.harvard.edu
Phillips Professor of Astronomy, Harvard University
Director of Origins of Life Initiative

Prof. Lisa Kaltenegger lkaltenegger@astro.cornell.edu
Associate Professor at Cornell University & Director of Carl Sagan Institute

Teaching reference: **Prof. Robert Kirshner** rkirshner@cfa.harvard.edu
Clowes Professor of Science, Harvard University
Chief Program Officer for Science at the Gordon & Betty Moore Foundation