Chloe Elizabeth Fisher

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INTERESTS

I am working on developing atmospheric retrieval methods involving machine learning techniques for extrasolar planets. I use both high- and low-resolution data, and also study the theory of transmission spectra. I aim to use machine learning to analyse multiple datasets simultaneously and consider three-dimensional effects.

Key words: *Exoplanet atmospheres, machine learning, Bayesian inference*

EMPLOYMENT

2022—24 University of Oxford, UK
SNF Mobility Fellow
Brasenose College Nicholas Kurti Junior Research Fellow

2021—22 University of Bern, Switzerland
Scientific Researcher

EDUCATION

Ph.D. Astrophysics, *summa cum laude*, University of Bern, Switzerland, 2021

M.Sci Natural Sciences, first class honours, University of Cambridge, UK, 2016

B.A. Mathematics, upper second class honours, University of Cambridge, UK, 2015

PUBLICATIONS

11. **Fisher, C.**, & Heng, K. 2022, ApJ, 934, 31
How Do We Optimally Sample Model Grids of Exoplanet Spectra?

10. Prinoth, B., Hoeijmakers, H.J., Kitzmann, D., Sandvik, E., Seidel, J.V., Lendl, M., Borsato, N.W., Thorsbro, B., Anderson, D.R., Barrado, D., Kravchenko, K., Allart, R., Bourrier, V., Cegla, H.M., Ehrenreich, D., **Fisher, C.**, Lovis, C., Guzmán Mesa, A., Grimm, S., Hooten, M., Morris, B.M., Oreshenko, M., Pino, L., & Heng, K. 2021, Nature Astronomy
Titanium oxide and chemical inhomogeneity in the atmosphere of the exoplanet WASP-189 b

9. Grimm, S.L., Malik, M., Kitzmann, D., Guzmán Mesa, A., Hoeijmakers, H.J., **Fisher, C.**, Mendonça, J.M., Yurchenko, S.N., Tennyson, J., Alesina, F., Buchschacher, N., Burnier, J., Segransan, D., Kurucz, R.L., & Heng, K. 2021, ApJS, 253, 30
HELIOS-K 2.0 Opacity Calculator and Open-source Opacity Database for Exoplanetary Atmospheres

8. Guzmán Mesa, A., Kitzmann, D., **Fisher, C.**, Burgasser, A.J., Hoeijmakers, H.J., Márquez-Neila, P., Grimm, S.L., Mandell, A.M., Sznitman, R., & Heng, K. 2020, AJ, 160, 15
Information Content of JWST NIRSpec Transmission Spectra of Warm Neptunes

7. **Fisher, C.**, Hoeijmakers, H.J., Kitzmann, D., Márquez-Neila, P., Grimm, S.L., Sznitman, R., & Heng, K. 2020, AJ, 159, 192
Interpreting High-resolution Spectroscopy of Exoplanets using Cross-correlations and Supervised Machine Learning

6. Oreshenko, M., Kitzmann, D., Márquez-Neila, P., Malik, M., Bowler, B.P., Burgasser, A.J., Sznitman, R., **Fisher, C.**, & Heng, K. 2020, AJ, 159, 6
Supervised Machine Learning for Intercomparison of Model Grids of Brown Dwarfs: Application to GJ 570D and the Epsilon Indi B Binary System

5. **Fisher, C.**, & Heng, K. 2019, ApJ, 881, 25
How Much Information Does the Sodium Doublet Encode? Retrieval Analysis of Non-LTE Sodium Lines at Low and High Spectral Resolutions

4. Hoeijmakers, H.J., Ehrenreich, D., Kitzman, D., Allart, R., Grimm, S.L., Seidel, J.V., Wyttenbach, A., Pino, L., Nielsen, L.D., **Fisher, C.**, Rimmer, P.B., Bourrier, V., Cegla, H.M., Lavie, B., Lovis, C., Patzer, A.B.C., Stock, J.W., Pepe, F.A., & Heng, K. 2019, A&A, 627, A165
A spectral survey of an ultra-hot Jupiter: Detection of metals in the transmission spectrum of KELT-9b

3. Seidel, J.V., Ehrenreich, D., Wyttenbach, A., Allart, R., Lendl, M., Pino, L., Bourrier, V., Cegla, H.M., Lovis, C., Barrado, D., Bayliss, D., Astudillo-Defru, N., Deline, A., **Fisher, C.**, Heng, K., Joseph, R., Lavie, B., Melo, C., Pepe, F., Ségransan, D., & Udry, S. 2019, A&A, 623, A166
Hot Exoplanet Atmospheres Resolved with Transit Spectroscopy (HEARTS) - II. A broadened sodium feature on the ultra-hot giant WASP-76b

2. **Fisher, C.**, & Heng, K. 2018, MNRAS, 481, 4698
Retrieval analysis of 38 WFC3 transmission spectra and resolution of the normalization degeneracy

1. Márquez-Neila, P., **Fisher, C.**, Sznitman, R., & Heng, K. 2018, Nature Astronomy, 2, 719
Supervised machine learning for analysing spectra of exoplanetary atmospheres

OBSERVING PROPOSALS

As Program PI

2. JWST NIRSpec, Cycle 2, ID 4126, 19.82 Hours
TOI-125: Comparative Atmospheric Chemistry Within One System

1. JWST NIRSpec, Cycle 2, ID 4195, 24.72 Hours
Constraining the Oxidation State of the Super-Earth TOI-1685 b

As Program co-I

JWST

7. NIRSpec, Cycle 2, ID 3969, 61.53 Hours, PI: Néstor Espinoza
Hot Jupiter Atmospheric Forecast: Are mornings cloudier than evenings in other worlds?

6. MIRI, Cycle 2, ID 3730, 115.11 Hours, PI: Hannah Diamond-Lowe
The Hot Rocks Survey: Testing 9 Irradiated Terrestrial Exoplanets for Atmospheres

5. NIRISS, Cycle 2, ID 3279, 13.15 Hours, PI: Jens Hoeijmakers
Calibrating NIRISS order 3 for very bright time-series observations with JWST

4. NIRSpec, Cycle 1, ID 2319, 24.9 Hours, PI: Matthew Hooton
TOI-178: The Best Laboratory for Testing Planetary Formation Theories

3. NIRISS, Cycle 1, ID 2113, 15.6 Hours, PI: Néstor Espinoza
Exploring the Morning and Evening Limbs of a Transiting Exoplanet

2. NIRSpec, Cycle 1, ID 2159, 14.9 Hours, PI: Néstor Espinoza
The First Near-infrared Spectroscopic Phase-curve of a Super-Earth

1. NIRSpec, Cycle 1, ID 2420, 24.9 Hours, PI: Alex Rathcke
Probing the Terrestrial Planet TRAPPIST-1c for the Presence of an Atmosphere

ESO

8. CRIRES, Period 111, 0.5 Nights, PI: Jens Hoeijmakers
Observing the Hanle Effect in an Exoplanet Transmission Spectrum

7. CRIRES, Period 109, 0.5 Nights, PI: Brian Thorsbro
TiO Condensation or High C/O? Measuring the C/O Ratio of an Ultra-Hot Jupiter with CRIRES

6. CRIRES, Period 109, 4 Hours, PI: Jens Hoeijmakers
Spin-Orbit Alignment and Mutual Inclinations of the HR 8799 Planets

5. CRIRES, Period 108, 2 Nights, PI: Jens Hoeijmakers
   Searching for an Atmosphere of 55 Cnc e and Measuring the Inclination of 55 Cnc b from L-Band Emission with CRIRES+
4. CRIRES, Period 107, 6.4 Hours, PI: Nicholas Borsato
   A Reducing, Hydrogen-Dominated Atmosphere on a Warm Earth-Sized Exoplanet?
3. ESPRESSO, Period 107, 0.5 Nights, PI: Bibiana Prinoth
   The End of the TiO Conundrum
2. ESPRESSO, Period 106-107, 4 Nights, PI: Jens Hoeijmakers
   Metals on the Day-Side of WASP-121 b with ESPRESSO: Absence of Titanium and Titanium Oxide?
1. HARPS, Period 103, 3 Nights, PI: Jens Hoeijmakers
   Iron and Titanium in the Atmosphere of the Ultra-Hot Jupiter WASP-189 b

FELLOWSHIPS & AWARDS

2022 Nicholas Kurti Junior Research Fellowship, Brasenose College, University of Oxford
2022—24 SNSF Postdoc.Mobility Fellowship (112,000 CHF)
2022 The Greinacher Foundation PhD Prize
2022 IAU Division F Honorable PhD Prize
2021 University of Bern Physics and Astronomy Faculty PhD Award
2021 SSAA MERAC Funding and Travel Award (4500 CHF)
2017—20 University of Bern International 2021 PhD Fellowship
2016 Bundy Scholarship, University of Cambridge
2016 Magdalene College Natural Sciences Award, University of Cambridge

SELECTED PROFESSIONAL TALKS

2023 JWST Exoplanet Atmospheres Meeting, Oxford, UK
2022 SPIMAX, Oxford, UK
2022 The Next Generation of European Extrasolar Scientists Conference, UK, Virtual (invited)
2021 SSAA General Assembly, Switzerland, Virtual (invited)
2021 Young Physicists Forum, Switzerland, Virtual (invited)
2020 Seminar at California Institute of Technology, Virtual
2020 University of Chicago Journal Club, Virtual
2020 Applied Machine Learning Days, Lausanne, Switzerland
2019 DPS/EPSC Geneva, Switzerland
2019 Junior Researchers Assembly, Lenzerheide, Switzerland
2018 Spectroscopy of Exoplanets, Windsor, UK
2018 DTU Workshop, Copenhagen, Denmark

ACADEMIC SERVICE & LEADERSHIP

2022— Oxoplanets journal club organiser
2022— Committee member for the Oxford Physics Gender Equity Network (OPGEN)
2020— Referee for A&A and AAS journals
2022 LOC & SOC for PlanetS Junior Researchers' Assembly
2021—22 Bern Exoclimes group meeting organiser

2021 SOC for ESO Atmo 2021 conference
2020 Student representative for the CSH self-evaluation committee
2017—19 Translator for physics exercises

TEACHING & MENTORING

2023 Supervisor for undergraduate summer project, Oxford, *Alex McGinty*
2022 Supervisor for undergraduate summer project, Oxford, *Ailsa Campbell*
2018— Co-supervisor for high school student, Bern, *Jehan Alsawaf*
2020—21 Teaching assistant for Bachelor's and Master's physics exercises and lab courses, Bern
2019 Teaching assistant for Master's course *Advanced Statistical Methods for Physicists*, Bern
2017 Physics A-Level teaching assistant, the Cherwell School, Oxford
2013—14 Student mentor for the University of Cambridge STEP School

OUTREACH

2021 Invited talk at the Young Physicists Forum, Switzerland
2021 Astronomy introduction sessions with a primary school child, Oxford
2019 Talk at A-Level certificates evening, the Cherwell School, Oxford
2019 Video for International Relations, Bern
2019 Talk at Pint of Science, Bern