Spencer Bialek

PhD Physics & Astronomy, University of Victoria
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Education

University of Victoria — Victoria, BC
Ph.D. Physics & Astronomy — *Jan. 2020 – Dec. 2023*
- Relevant research work: Applied Deep Learning, Cloud Computing, Python Development, Big Data

University of Victoria — Victoria, BC
M.Sc. Physics & Astronomy — *Sep. 2017 – Dec. 2019*
- Relevant research work: Python development, Applied Machine Learning
- Relevant coursework: Machine Learning, Neural Networks, Distributed Computing

University of Victoria — Victoria, BC
B.Sc. Honours Physics & Astronomy with Co-op Distinction — *Sep. 2011 – May 2017*

Skills and Qualifications

Programming Languages: Python (11 years), C++ (2 years), Java (1 year), Octave (1 year), HTML/CSS
Software & Tools: Git, Docker, Slurm, OpenStack, PyCharm, VS Code, LaTeX, Excel
Libraries: Pandas, NumPy, Matplotlib, Seaborn, Sklearn, Pytorch, Tensorflow, AstroPy, Jupyter
Communication skills: Science writing, outreach, public speaking, data visualization

Honours, scholarships, and awards

President's Research Scholarship — 2020 – 2023

NSERC Postgraduate Scholarship – Doctoral — 2020 – 2023
Provides financial support to high-calibre students who are engaged in an eligible doctoral program in natural sciences or engineering

NSERC CREATE Scholarship — 2020 – 2022
Supports the training and mentoring of highly qualified students in professional development and provides experience in industry related to Canada's research priorities

Boehm-Hesser Graduate Research Excellence in Astronomy Award — 2020
Given to graduate students in the Department of Astronomy for excellence in research

UVic Graduate Award — *2017-2020*

UVic Fellowship — *2017*

Boehm Family Award for Excellence in Science — *2016*

Robert S. Evans Memorial Scholarship — *2016*

2nd place in poster fair at Canadian Undergraduate Physics Conference — *2016*

Outstanding Co-op Work Term Report — *2014*

Work/Industry Experience

Research Internship — Waimea, HI
Canada-France-Hawaii Telescope — *May 2022 – October 2022*
- Helped build simulation software using `Pytorch` to generate training and test sets of observations of stars with atmospheric turbulence and noise
- Developed a novel machine learning system which infers in real-time the turbulence- and noise-free image from a video sequence of short-exposure images over a wide field
- Turned into main project of Ph.D.
- Primary authorship of peer-reviewed publication in preparation

Research and Software Development Internship — Victoria, BC
Limbic Media — *May 2018 – Sep. 2018*
- Curated and reduced a training set of audio spectrogram data from thousands of songs
- Implemented a neural network-based analysis of music boundary detection for the Aurora sound-responsive lighting system, doubling the performance over competing methods

Research Assistant Co-op Victoria, BC

NRC Herzberg Astronomy and Astrophysics *May 2017 – Sep. 2017*

- Created a machine learning pipeline capable of deriving fundamental properties of stars including temperature, surface gravity, and metallicity

Research Experience

University of Victoria, Ph.D. Physics & Astronomy Victoria, BC

Project: StarUnlink *2021 – 2022*

- Pioneered a deep learning framework using CNN and U-Net architectures to detect when a stellar spectrum is contaminated by an orbiting communications satellite from companies like Starlink, and either accurately predict the star's properties despite the contamination, or remove the contamination from the data for downstream tasks
- Joined the International Astronomical Union's Centre for the Protection of the Dark and Quiet Sky from Satellite Constellation Interference (IAU-CPS)
- Primary authorship of peer-reviewed publication and presentation at IAU Symposium

Project: Automatic Galaxy Morphology Classification *2021 – 2023*

- Created a contrastive self-supervised method for automating the classification of galaxy morphologies from the UNIONS survey using learned neural network features. The "galaxy recommender" system finds the most similar galaxies to a galaxy of interest, helping to discover new examples of rare types of galaxies
- Currently helping supervise a small team to expand on this work

University of Victoria, M.Sc. Physics & Astronomy Victoria, BC

Project: StarNet *2017 – 2019*

- Built an end-to-end cloud-computing pipeline that generates a large set of (several hundred thousand) synthetic stellar spectra, trains a deep ensemble machine learning model on them, and predicts stellar parameters and chemical abundances – along with uncertainties – for several spectroscopic surveys in seconds
- Evaluated the quality of several commonly used libraries of synthetic stellar spectra to provide recommendations to the astronomical community
- Primary authorship of peer-reviewed publication and poster at national conference

Teaching Experience

Teaching Assistant Victoria, BC

University of Victoria *2017 – Present*

- Taught the laboratory sections for several courses at the University of Victoria: ASTR 101, ASTR 102, ASTR 150, ASTR 201, and PHYS 216
- Lectured, demonstrated laboratory procedures, and facilitated discussions
- Helped organize and prepare the teaching materials for other teaching assistants

Peer-Reviewed Publications

1. Ferreira, A., O'Briain, T., **Bialek, S.**, Fabbro, S. (2024). "Dark Sky Self-Supervised Representation Learning" Monthly Notices of the Royal Astronomical Society – *in preparation*.
2. **Bialek, S.**, Bertin, E., Fabbro, S. (2024). "DanceCam: Atmospheric turbulence mitigation in wide-field astronomical images with short-exposure video streams" Monthly Notices of the Royal Astronomical Society, stae1018.
3. **Bialek, S.**, Lucatello, S., Fabbro, S., Yi, K. M., & Venn, K. A. (2023). "StarUnLink: Identifying and mitigating signals from communications satellites in stellar spectral surveys." Monthly Notices of the Royal Astronomical Society, 524(1), 529-541.
4. O'Briain, T., Ting, Y. S., Fabbro, S., Kwang, M. Y., Venn, K., & **Bialek, S.** (2021). "Cycle-StarNet: Bridging the Gap between Theory and Data by Leveraging Large Data Sets." The Astrophysical Journal, 906(2), 130.
5. **Bialek, S.**, Fabbro, S., Venn, K. A., Kumar, N., O'Briain, T., & Yi, K. M. (2020). "Assessing the performance of LTE and NLTE synthetic stellar spectra in a machine learning framework." Monthly Notices of the Royal Astronomical Society, 498(3), 3817-3834.
6. Fabbro, S., Venn, K. A., O'Briain, T., **Bialek, S.**, Kielty, C. L., Jahandar, F., & Monty, S. (2018). "An application of deep learning in the analysis of stellar spectra." Monthly Notices of the Royal Astronomical Society, 475(3), 2978-2993.

Poster and Podium Presentations

1. **Bialek, S.**, Bertin, E., Fabbro, S. "Wide-field atmospheric turbulence mitigation using short-exposure video sequences and machine learning" Canadian Astronomical Instrumentation Workshop; Montreal, QC (2023).
2. O'Briain, T., Ting, Y. S., Fabbro, S., Kwang, M. Y., Venn, K., & **Bialek, S.**. "Decreasing the Gap between Synthetic and Real Data... finally automated" Invited seminar at Columbia University; New York, NY (2021).
3. **Bialek, S.**, Fabbro, S., Venn, K. A., Kumar, N., O'Briain, T., & Yi, K. M. "Machine learning for stellar spectroscopy" Statistical Challenges in Modern Astronomy (SCMA) VII (2021).
4. **Bialek, S.**, Fabbro, S., Venn, K. A., Kumar, N., O'Briain, T., & Yi, K. M. "Machine learning for stellar spectroscopy" Summer School in Statistics for Astronomers; Penn State University (2021).
5. **Bialek, S.**, Fabbro, S., Venn, K. A. "StarNet: Harnessing the power of deep learning for stellar spectroscopy" European Astronomical Society (EAS) Annual Meeting (2020, 2021).
6. **Bialek, S.**, Fabbro, S., Venn, K. A. "Various StarNet related posters" Canadian Astronomical Society (CASCA) Annual Meeting (2017, 2018, 2019, 2020, 2021).
7. **Bialek, S.**, Fabbro, S., Venn, K. A. New Technologies for Canadian Observatories (NTCO) Annual Meeting. Invited talk (2019).

Volunteering and Public Outreach

Nerd Nite Victoria Victoria, BC

Volunteer *2019-2021*

- Organized, co-hosted, and created promotional materials for the monthly science outreach event Nerd Nite.

AstroCoffee Victoria, BC

Facilitator *2019-2021*

- Organized and facilitated weekly informal meetings for astronomers at UVic to discuss new research

Black Rock Observatory Black Rock Desert, NV

Volunteer *2017, 2019*

- Operated several telescopes at Burning Man while teaching people about the celestial objects they were observing

Bass Coast Festival Merritt, BC

Astronomer on Duty *2017, 2018, 2019*

- Facilitated discussions of astronomical phenomena while operating a telescope