

# Anran Xu

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## EDUCATION

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### The University of British Columbia

*Doctor of Philosophy in Geophysics*

Vancouver, Canada

2025.02-present

- Four Year Doctoral Fellowship (UBC)
- President's Academic Excellence award

### The University of British Columbia

*Master of Science in Geophysics*

Vancouver, Canada

2022.09-2024.10

- Outstanding Student Presentation Award (AGU 2023)

### University of Toronto

*Honours Bachelor of Science*

Toronto, Canada

2018.09-2022.06

*Mathematics & Its Applications Specialist (Physical Science); Physics Major*

- GPA: **3.91/4.0**
- Dean's List Scholar (Fall/Winter 2019-2020 & 2020-2021)
- The Don Salt Memorial Scholarship (Canadian Exploration Geophysical Society (KEGS))
- New College Council In-Course Scholarship
- Summer Undergraduate Research Program (SURP) in astronomy & astrophysics

## SELECTED RESEARCH EXPERIENCE

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### Neural Fields for Imaging Inverse Problems in Fluorescence Microscopy (CNRS internship)

Sophia-Antibus, France

2024.05-2024.10

*Advisor: Luca Calatroni and Laure Blanc-Féraud, CNRS*

- Developed an NF-based approach to represent continuous positions of fluorescent molecules, enhancing fluorescence microscopy by addressing challenges such as blur, noise, and undersampling
- Design a novel pipeline for the super-resolution using the PyTorch and DeepInverse
- Analyze the mechanism of the implicit regularization effect observed in the proposed pipeline

### Development of ML Methods for Power Spectrum Emulators (SURP internship)

Toronto, Canada

*Advisor: Dr. Keir Rogers, University of Toronto*

2022.05-2022.08

Poster: [http://www.astro.utoronto.ca/wp-content/uploads/2022/12/AnranXu\\_SURP2022.pdf](http://www.astro.utoronto.ca/wp-content/uploads/2022/12/AnranXu_SURP2022.pdf)

- Reviewed the literature about Cosmopower and axion dark matter cosmology
- Studied the background material on cosmology including cosmic microwave background, LSS matter density, etc.
- Used the axionCAMB package to generate a dataset with different LCDM parameters' space
- Grasped the Cosmopower packages to train a DNN that maps the input cosmological parameters to CMB and matter power spectra in an axion dark matter cosmology model, achieving error less than  $0.06\sigma$  for 99% of the CMB spectra

### Visual Sentiment Analysis using Deep Learning Models

Toronto, Canada

*AI4Good Lab (Amii)*

2022.05-2022.07

- Reviewed the existing research literature on image sentiment analysis
- Collaborated with team members to write a project proposal
- Pre-processed the collected data to create a labeled dataset
- Built and optimized a convolutional neural network (CNN) model using transfer learning from ResNet50v2, achieving accuracy of 72% for the training set and 75% for the validation set

### Development of AI Methods for Finding Hidden Dimensions

Toronto, Canada

*Advisor: Dr. Hazem Daoud, University of Toronto*

2021.05-2021.08

- Reviewed the literature about diffraction pattern analysis using machine learning methods, and explored how A.I.

can aid in matching changes in diffraction pattern to structural changes of bismuth

- Gained essential knowledge and skills by taking two courses: *Deep Learning Specialization* and *TensorFlow Developer Professional Certificate* on Coursera
- Exported the synthetic profiles of the electron diffraction patterns and converted them into the ring-like electron diffraction images using Python
- Built and optimized a convolutional neural network (CNN) model, achieving accuracy of 93.2% for the training set and 91.15% for the validation set
- Used the CNN model to predict the Uiso values of real diffraction patterns, and the prediction has the right trend

### **Moment Tensor Inversion for the Mw=6.5 Earthquake in Nevada**

Toronto, Canada

*Advisor: Prof. Qinya Liu, University of Toronto*

2021.05-2021.07

- Studied background material on seismic wave equation, seismic wave propagation, and earthquake source representations (focal ball, moment tensor)
- Grasped software packages (gCAP & FK package) on seismic data processing and source mechanism inversions
- Used FK package to calculate the required Green's functions in multi-layered media
- Performed moment-tensor inversion about the Mw=6.5 earthquake in Nevada in 2020 using gCAP package, the result shows that most of segments have correlation coefficients greater than 90 (100 is the maximum)

### **Selected Conferences and Publications**

**(† indicates award)**

*a. Articles published or accepted in peer-reviewed journals.*

1. **Xu, A.** and Heagy, L. J. (2025) Toward Understanding the Benefits of Neural Network Parameterizations in Geophysical Inversions: A Study With Neural Fields. *IEEE Transactions on Geoscience and Remote Sensing*, vol. 63, pp. 1-14.
2. **Xu, A.** and Heagy, L. J. (2024) A Test-Time Learning Approach to Reparametrize the Geophysical Inverse Problem With a Conventional Neural Network. *IEEE Transactions on Geoscience and Remote Sensing*, vol. 62, pp. 1-12.

*b. Other peer-reviewed contributions*

3. **Xu, A.\*** and Heagy, L. J. (2025) Exploring Why the Implicit Regularization Effects Provided by Neural Networks Can Be Effective for Geophysical Inversions. *KEGS (Canadian Exploration Geophysical Society) Symposium*, Toronto, Canada (National, oral presentation).

*c. Non-peer-reviewed contributions*

4. **Xu, A.\*** and Heagy, L. J. (2024) Leveraging Neural Fields for Geophysical Inverse Problems. *SIAM (Society for Industrial and Applied Mathematics) Conference on Mathematics of Data Science*, Atlanta, Georgia, U.S. (International, poster presentation).
5. † **Xu, A.\***, Heagy, L. J., and Weis, J. (2023) Leveraging Convolutional Neural Networks for Implicit Regularization in DC Resistivity Inversions. *AGU Fall Meeting*, vol. 2023, no. 7, Art. No. NS33C-07, San Francisco, CA, U.S. (International, e-poster presentation).
6. **Xu, A.\*** and Heagy, L. J. (2023) Reparametrizing the Geophysical Inverse Problem using a Convolutional Neural Network. *7<sup>th</sup> International Symposium on Three-Dimensional Electromagnetics*, Vancouver, BC, Canada (International, poster presentation).
7. **Xu, A.\*** and Rogers, K. K. (2022) AxionEmu: A Power Spectrum Emulator for Axion Dark Matter Cosmologies. (poster)
8. **Xu, A.\*** and Rogers, K. K. (2022) Neural Network Emulators of Axion Einstein-Boltzmann Solvers. (preprint)

### **WORK EXPERIENCE**

**Teaching Assistant**

Vancouver, Canada

Instructor: Lindsey Heagy

EOSC 350: Environmental, Geotechnical, and Exploration Geophysics at University of British Columbia

### **SKILLS**

**Language:** Chinese Mandarin (Native), English (Fluent)

**Computer Skills:** Python (PyTorch and TensorFlow), Julia, LaTeX, BASH shell, Linux