

Workshop

Machine Learning in Scanning Transmission Electron Microscopy

Monday July 3rd:

Atomic Resolution STEM, Deep Convolutional Neural Networks, and Variational Auto Encoder

8:30 – 9:00 Welcome

9:00-10:00 Principles of Electron Optics and Aberration Correction in STEM (Duscher)

10:00-10:50 Remote Aberration Correction in STEM (Duscher, Houston)

11:10-12:00 Simulation of Ronchigrams [Participant computer] (Duscher)

12:00-1:00 Lunch (provided for registered onsite participants)

1:00-2:00 Remote Atomic Resolution Imaging (Duscher)

2:00-2:50 Methods of Atom Position determination [Participant computer] (Duscher, Kalinin)

3:20 -4:00 Training datasets and Neural Networks (Kalinin, Houston, Pratijs)

4:00-5:00 Advanced Machine Learning of Atomically Resolved Images

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Tuesday July 4th:

Electron Diffraction, 4D-STEM, and Variational Auto Encoder

- 9:00-10:00 Introduction to Diffraction (Duscher)
- 10:00-10:50 Remote Diffraction Acquisition in STEM (Duscher, Houston)
- 11:10-12:00 Simulation of Diffraction Pattern (Duscher)
- 12:00-1:00 Lunch (provided for registered onsite participants)
- 1:00-2:00 Analyzing Diffraction pattern [Participant computer] (Duscher, Houston)
- 2:00-2:50 4D STEM (Houston)
- 3:20 -4:00 Training datasets and Neural Networks for Diffraction (Kalinin, Houston, Pratius)
- 4:00-5:00 Advanced Machine Learning for 4D-STEM

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Wednesday July 5th:

Energy Dispersive X-Ray Spectroscopy , Principal Component Analysis, and Non-Negative Matrix Factorization

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9:00-10:00 Introduction to Energy Dispersive X-ray spectroscopy (Duscher)

10:00-10:50 Remote Acquisition of EDS spectra in STEM (Duscher, Houston)

11:10-12:00 Analysis of EDS [Participant computer] (Duscher)

12:00-1:00 Lunch (provided for registered onsite participants)

1:00-2:00 Introduction to Electron Energy Loss spectroscopy (Duscher)

2:00-3:50 Remote Acquisition of EELS spectra in STEM (Duscher, Houston)

3:20-4:00 Analysis EELS [Participant computer] (Duscher)

4:00- 5:00 Clustering in Spectroscopy

Thursday July 6th:

Electron Energy-Loss Spectroscopy,

9:00-10:00 Introduction to Principles of Machine Learning

10:00-10:50 Principles of Neural Networks for Spectroscopy [Participant computer]
(Kalinin, Houston, Pratijs)

11:10-12:00 Advanced Machine Learning for Spectroscopy

12:00-1:00 Lunch (provided for onsite participants)

1:00-2:00 Convolutional Neural Network

2:00-2:50 Deep Kernel Neural Networks

3:20 -4:00 Principles of Neural Networks for Spectroscopy II [Participant computer]
(Kalinin, Houston, Pratijs)

4:00-5:00 Advanced Machine Learning Tools

Friday July 7th:

Energy Dispersive X-Ray Spectroscopy, Deep Kernel Learning, and human-in the loop automated experiment (hAE)

9:00-10:00 Introduction to Remote Access to STEM (Duscher)

10:00-10:50 Remote Acquisition of data with remote computers (Pratius, Houston)

11:10-12:00 Introduction to sparse matrices in acquisition

12:00-1:00 Lunch (provided for onsite participants)

1:00-2:00 Principles of Bayesian Optimization

2:00-2:50 New methods enabled by remote computer-controlled acquisition (Kalinin)

3:20 -4:00 Advanced Machine Learning

4:00-5:00 Conclusion