



Ph.D. in Mechanical Engineering from the University of Texas at Austin with a specialization in machine learning for nanoscale metrology. Develops and deploys deep-learning and computer vision methods to reconstruct and analyze microscopy data with emphasis on atomic force microscopy and builds end-to-end pipelines for data acquisition, preprocessing, feature reconstruction, and visualization at scale. Experienced collaborating and training with experimentalists to design data collection strategies and integrating machine learning tools into high performance computing and research codebases. Record of peer-reviewed publications and technical presentations.

KEY SKILLS

- **Machine learning:** deep learning, computer vision, noisy image reconstruction, statistical data analysis, pattern recognition
- **Programming:** Python (PyTorch, Lightning, Pandas, NumPy, multiprocessing), MatLab, Mathematica, high-performance computing (HPC), SLURM, Git
- **Materials characterization:** Atomic force microscopy (AFM), optical profilometry
- **Manufacturing & Design:** SolidWorks, CAD modeling, CNC milling, CNC press brake, MasterCam

EDUCATION

University of Texas, Austin TX
Advisor: Dr. Michael Cullinan
Nanoscale Design and Manufacturing
Laboratory

Ph.D. Engineering, 2025

University of Texas, Austin TX
Advisor: Dr. Michael Cullinan
Nanoscale Design and Manufacturing
Laboratory

M.S. Engineering, 2022

Austin College, Sherman TX
Major: Physics
Minors: Math, Spanish

B.A. Physics, 2019

EXPERIENCE

Sandia National Laboratories

Postdoctoral Appointee, 2025 — Current

Postdoctoral Researcher at the Center for Integrated Nanotechnologies

Advisor: Dr. Rémi Dingreville

- Computer vision models for accelerated nanoscale microscopy and materials characterization.
- Massive data augmentation workflows for machine learning applied to microscopy with scarce experimental data.
- Multimodal data fusion of disparate microscopy methods to characterize creep behavior in metals.

Sandia National Laboratories

R&D Intern, 2021-2025

Graduate Research Intern at the Center for Integrated Nanotechnologies

Advisor: Dr. Rémi Dingreville

- Nanometrology data analysis and sparse image reconstruction with machine learning and high-performance computing systems.
- Designed data processing and feature reconstruction pipelines for nanoscale microscopy datasets with emphasis on adaptability and reproducibility.
- Collaborated and trained with experimentalists for design of data collection experiments for quality ML training and validation.

University of Texas at Austin

Graduate Researcher, 2019-2025

Graduate Researcher in the Nanoscale Design and Manufacturing Laboratory

Advisor: Dr. Michael Cullinan

- Developed novel data management and training pipelines for machine learning in accelerating nanoscale characterization methods, with limited data.
- Optimization of large-scale nanometrology (atomic force microscopy) and error correction techniques using high-performance computing.
- B-spline curve and NURBS surface modeling of 3D AFM data in python.

Machined Form Design

SolidWorks & CAD Intern, Summer 2019

- 3D scanning (FARO 3D Scanner, Geomagic Wrap Scan Processor) and SolidWorks CAD modeling for custom automotive redesigns and builds.

Austin College

Physics Teaching Assistant, 2018-2019

- Lab teaching assistant for Introductory Algebra-Based Physics class.

Office of Admissions Intern, 2015-2019

- Lab teaching assistant for Introductory Algebra-Based Physics class.

Undergraduate Researcher, 2016-2019

Advisors: Dr. David Baker, Dr. Donald Salisbury

- Photometric observations from the Adams Observatory in Support of NASA's TESS Mission.
- Modeled the behavior of gravitational waves and back reaction in a binary system in *Mathematica*.
- Photometric observations of confirmed exoplanets in support of the KELT-FUN collaboration.

University of Michigan Ann Arbor

NSF Sponsored REU, Summer 2018

Advisor: Dr. Jennifer Ogilvie

- Studied the reaction center of the photosystem II complex in spinach using ultra-fast interferometry.

Rensselaer Polytechnic Institute

NSF Sponsored REU, Summer 2017

Advisor: Dr. Vidhya Chakrapani

- Designed in SolidWorks a model for the XENON experiment in Italy.
- Studied changes in electric properties of transition metal oxides.

University of Texas at Austin

Undergraduate Intern, Summers 2015-2016

Advisors: Dr. Ron Matthews, Dr. Luis Sentis

- Longhorn Racing automotive engineering lab, working on designs to help improve engine performance efficiency.
- Human Centered Robotics Lab, studying augmented reality C++ programs.

ATX Machined Form

Founder/CEO, 2014-2016

- SolidWorks CAD modeling and CNC milling to produce billet aluminum drink coasters with custom automotive or logo designs.

Kustom Krates

Intern, Summers 2011-2016

- SolidWorks CAD modeling, CNC machine operation, NC Milling, and 3D scanning (FARO 3D Scanner, Geomagic Wrap Scan Processor).

HONORS & AWARDS

- National Science Foundation Graduate Research Fellow, 2021-2024
- Virginia & Ernest Cockrell, Jr. Fellowship in Engineering, 2019-2023
- T. W. Whaley, Jr. Friends of Alec Endowed Scholarship from the University of Texas Cockrell School of Engineering, 2019-2020
- Mary Foulks Gourley & Lloyd E. Gourley Prize for an Outstanding Student in Physics, 2018

PUBLICATIONS

Under review Natinsky, E., Khan, R. M., Cullinan, Q. Wang, D. Morris, M., & Dingreville, R (2026). "AFM-net: From Scarce Data to Fast Scans. Machine Learning Acceleration of Atomic Force Microscopy Nanometrology." *npj Computational Materials*.

- [4] Natinsky, E., Connolly, L.G., & Cullinan, M. (2024). "Three-dimensional visualization of large-area, nanoscale topography measurements." *Nanotechnology*, 35. <https://doi.org/10.1088/1361-6528/ad8165>.
- [3] Natinsky, E., Khan, R. M., Cullinan, M., & Dingreville, R. (2024). "Reconstruction of high-resolution atomic force microscopy measurements from fast-scan data using a Noise2Noise algorithm." *Measurement*, 227. <https://doi.org/10.1016/j.measurement.2024.114263>
- [2] Connolly, L., Natinsky, E., Khusnatdinov, N., Jones, C., Mizuno, M., Messl, M., . . . Cullinan, M. (2020). "The role of visualization and error correction in very large area, tip-based topography measurement." *American Society for Precision Engineering*.
- [1] Huber, D., Chaplin, W. J., Chontos, A., Kjeldsen, H., Christensen-Dalsgaard, J., Bedding, T. R., ... Howard, A. W. (2019). "A Hot Saturn Orbiting an Oscillating Late Subgiant Discovered by TESS." *The Astronomical Journal*, 157(6), 245. <https://doi.org/10.3847/1538-3881/ab1488>

CONFERENCES AND PRESENTATIONS

- Presentation:* “Accelerating atomic force microscopy using deep learning image reconstruction.” *UT Austin PhD defense*, October 2025.
- Invited Presentation:* “Accelerating atomic force microscopy using deep learning image reconstruction.” *Center for Integrated Nanotechnologies Annual User Meeting*, September 2025.
- Poster:* “Machine-learning image reconstruction overcomes atomic force microscopy data scarcity with domain specific corruption.” *Artificial intelligence and machine learning for materials workshop*, July 2025.
- Presentation:* “Integrating multimodal metrology with machine learning for reliable characterization in advanced chip packaging.” *Truman fellowship finalist proposal presentation*, January 2025.
- Poster:* “ML-driven image reconstruction can speed up microscopy data processing by 500x with image quality improvement up to 70%.” *Center for Integrated Nanotechnologies User Meeting*, September 2024.
- Presentation:* “Accelerating microscopy for nanoscale fabrication via deep-learning image reconstruction.” *UT Austin PhD research proposal*, April 2024.
- Presentation:* “Deep learning image reconstruction for microscopy data.” *Sandia National Laboratories BeyondFingerprinting Grand Challenge External Advisory Board Meeting*, April 2024.
- Poster:* “Reconstruction of sparse, nano-scale metrology data for efficient process control.” *Sandia Academic Alliance Spring UT Austin Research Poster Session*, March 2022.
- Presentation:* “Signal reconstruction of sparse, nano-scale metrology data for time efficient process control.” *IS&T Electronic Imaging Symposium*, January 2022.
- Presentation:* “Signal reconstruction of sparse, nano-scale metrology data using Noise2Noise.” *Sandia National Labs Academic Alliance Program*, July 2021.
- Poster:* “The role of visualization and error correction in very large area, tip-based topography measurement.” *American Society for Precision Engineering annual conference*, October 2020.
- Poster:* “Detection of exoplanets at the Austin College Adams Observatory.” *Austin College Scholarship Conference*, March 2018.
- Poster:* “Studying transition metal oxides by tracking electrochemical reactions.” *NSF sponsored REU at Rensselaer Polytechnic Institute*, August 2017.
- Presentation:* “Using ultrafast laser-pulse spectroscopy for observations of photosynthesis in spinach.” *NSF sponsored REU at the University of Michigan at Ann Arbor*, August 2018.
- Presentation:* “Simulating the back reaction in gravitational waves with a spring-mass system.” *Austin College Scholarship Conference*, March 2018.
- Presentation:* “Observing exoplanets with the Austin College Adams Observatory for admission in to KELT.” *Austin College Spring Research Presentations*, April 2017.