

# Md Imran Khan

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## Professional Summary

**PhD Physicist and Imaging Expert** with 4+ years of industry experience developing data-driven solutions for complex CD SEM imaging systems. Expert in computational modeling, image analysis, and extracting insights from large-scale datasets. Proven track record of building and deploying end-to-end Python solutions for automation, dashboarding, and image quality assessment, seeking to apply a deep foundation in optics, modeling, and algorithm development to challenging problems in optics, metrology, computer vision, and deep learning.

## Technical Skills

- **Programming & AI:** Python (PyTorch, OpenCV, scikit-image, Pillow, NumPy, pandas, Matplotlib), SQL, Git, Jupyter
- **Data Analysis & Modeling:** Statistical Process Control (SPC), JMP, Statistical Modeling, Dashboarding, Automation, COMSOL, MATLAB, LabView
- **Metrology & Imaging:** Scanning Electron Microscopy (SEM), CD-SEM, Optical Microscopy, Image Quality Analysis (CNR, Sharpness, FFT, GLCM)
- **Fabrication & Tools:** PECVD, RIE, Sputtering, Photolithography, TRPL, DLS

## Experience

- SEM Metrology Engineer  
Intel Corporation, Hillsboro, USA | November 2021 – August 2025
  - Primary tool owner of 4 CD-SEM systems and co-owner of 4 additional tools in a high-volume manufacturing environment.
  - Maintained Statistical Process Control (SPC) charts for fleet-wide metrology tools to monitor tool health and measurement stability.
  - Designed and deployed a Python dashboard for monitoring and anomaly detection in tool performance parameters (e.g., probe current, stigmation).
  - Led automation efforts by developing Python scripts to analyze DCCD round robin data across the SEM fleet—enhancing consistency checks and reporting accuracy.
  - Built a computer vision toolkit for automated SEM image assessment, implementing algorithms for sharpness, contrast-to-noise ratio, FFT-based sharpness score, and GLCM texture analysis to quantify focus and image integrity.
  - Collaborated with cross-functional teams to troubleshoot tool drift, optimize beam alignment, and reduce downtime.

## **Education**

- Ph.D., Physics (Optics & Computational Modeling), UC Merced | GPA: 3.6/4.0 | August 2016 – October 2021
- M.S., Physics, Binghamton University (SUNY) | May 2016

## **Research Experience (PhD Projects)**

- **Computational Modeling of Plasmonic Metastructures**
  - Developed a full-wave computational model to simulate multiple scattering and diffraction from 3D plasmonic nanostructures using the Method of Fundamental Solutions and the Foldy-Lax method.
  - Implemented the model in Python and MATLAB to calculate far-field scattering patterns and total cross-sections, analyzing the impact of design parameters on optical performance.
  - Validated model accuracy by nano-fabricating designed meta-structures and correlating measured scattering amplitudes with simulated results.
- **Optical Metrology for Energy Transfer in Nanoclusters**
  - Characterized nanoscale energy transfer (NSET/FRET) dynamics using Time-Resolved Photoluminescence (TRPL) spectroscopy.
  - Designed and integrated a custom optical system to enhance signal-to-noise ratio, enabling reliable measurement in dilute samples.

## **AI & Computer Vision Projects**

- **SEM Image Quality Toolkit:** A Python module for automated image assessment using classical CV algorithms (sharpness, CNR, FFT, GLCM texture features) to replace manual inspection.
- **DCCD Round Robin Analyzer:** An automated data analysis pipeline using pandas and statistical modeling to evaluate and ensure consistency across a fleet of imaging tools.
- **SEM Parameter Dashboard:** A real-time visualization tool for multi-variate time-series data from sensor systems, enabling predictive maintenance.

## **Publications (Selected)**

- Khan, M.I., et al., “Scattering by nanoplasmonic mesoscale assemblies,” JOSA A 42, 1244-1253 (2025).
- Khan, M.I., et al., “Modeling broadband cloaking using 3D nano-assembled plasmonic meta-structures”, Optics Express, 2020.

## **Awards & Affiliations**

- NSF-CREST Graduate Scholar, CCBM, UC Merced
- Graduate Scholar Mentor – Mentored undergraduate researchers on experimental methods and graduate school preparation