

Desheng Ma

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EDUCATION

2025	Cornell University <i>Ph.D., Applied Physics</i> <i>Minor: Theoretical Physics, Statistics</i>	Ithaca, NY, US
2021	Cornell University <i>M.S., Applied Physics</i>	Ithaca, NY, US
2019	Nankai University <i>B. S., Physics</i>	Tianjin, China
2016 – 2017	Columbia University <i>Visiting Student, Columbia College Visiting Student Program</i>	New York, NY, US

RESEARCH INTERESTS

4D STEM, Imaging Theory, Electron Ptychography, Aberration Correction, Accelerator and Beam Physics, Machine Learning for Physical Sciences

RESEARCH EXPERIENCE

2019 – pres.	Cornell University School of Applied Physics and Engineering <i>PhD student in the group of Prof. David Muller</i> <ul style="list-style-type: none">– Novel imaging methods in 4D-STEM<ul style="list-style-type: none">• Aberration-corrected bright-field imaging. https://arxiv.org/abs/2510.01493• Information transfer in 4D-STEM. https://arxiv.org/abs/2507.21034• Information limit and dose efficiency of electron ptychography. https://doi.org/10.1093/mam/ozae044.910– Emittance minimization for aberration correction via machine learning and Bayesian optimization. part I: ultramic.2025.114137; part II: ultramic.2025.114138– Multi-objective Bayesian optimization for electron ptychography– In-situ diffraction and 4DSTEM imaging of 2h-TaSe2 CDW domains.
2020 – 2022	Cornell University Samuel Curtis Johnson Graduate School of Management <i>Research Assistant with Prof. Shawn Mankad</i> <ul style="list-style-type: none">– A Structural Model for Latent Ratings and Topics in Text (draft available)– CP-Squared: A method for change point detection in core-periphery networks SSRN 3742790
2017/2018 Summer	Columbia University Department of Physics <i>Research Intern with Prof. Sebastian Will</i> <ul style="list-style-type: none">– New experimental setup for the laser cooling and trapping of ultracold dipolar molecules
2015/2016	Institute of Metal Research (IMR), Chinese Academy of Sciences <i>Undergraduate researcher (summer research) in electron microscopy</i>

WORK IN PROGRESS

- [2] **D. Ma**, D.A. Muller, S.E. Zeltmann. “Using Aberrations to Improve Dose-Efficient Tilt-corrected 4D-STEM Imaging”, submitted to *Microscopy and Microanalysis*. <https://arxiv.org/abs/2510.01493>
- [1] **D. Ma**, G. Li, D.A. Muller, S.E. Zeltmann. “Information in 4D-STEM: Where it is, and How to Use it”, submitted to *Ultramicroscopy*. <https://arxiv.org/abs/2507.21034>

PUBLICATIONS

- [4] **D. Ma**, C. Zhang, YT. Shao, et al. “Emittance Minimization for Aberration Correction via Machine Learning and Bayesian Optimization.” *Microscopy and Microanalysis, Volume 31, Issue Supplement 1*, oza048. 1068 (2025)
- [8] C-H. Lee, S. Zeltmann, D. Yoon, **D. Ma**, D. Muller. “PtyRAD: A High-performance and Flexible Ptychographic Reconstruction Framework with Automatic Differentiation.” *Microscopy and Microanalysis 31.4 (2025)* (2025)
- [7] **D. Ma**, S. Zeltmann, C. Zhang, et al. “Emittance Minimization for Aberration Correction II: Physics-informed Bayesian Optimization of an Electron Microscope.” *Ultramicroscopy, Volume 273, July 2025, 114138* (2025)
- [6] **D. Ma**, S. Zeltmann, C. Zhang, et al. “Emittance Minimization for Aberration Correction I: Aberration correction of an electron microscope without knowing the aberration coefficients.” *Ultramicroscopy, Volume 273, July 2025, 114137* (2025)
- [5] **D. Ma** and D. Muller. “Information Limit and Dose Efficiency of Electron Ptychography.” *Microscopy and Microanalysis, Volume 30, Issue Supplement 1*, ozae044.910 (2024)
- [4] **D. Ma**, C. Zhang, YT. Shao, et al. “Physics-informed Bayesian Optimization of an Electron Microscope.” *Microscopy and Microanalysis, Volume 29, Issue Supplement 1*, ozad067.968 (2023)
- [3] S. Zhang, X. Guo, Y. Tang, **D. Ma**, et al. “Polarization rotation in ultrathin ferroelectrics tailored by interfacial oxygen octahedral coupling.” *ACS nano* 12, 3681–3688 (2018)
- [2] Y. Feng, Y. Tang, **D. Ma**, et al. “Thickness-dependent evolution of piezoresponses and stripe 90 domains in (101)-oriented ferroelectric PbTiO₃ thin films.” *ACS applied materials & interfaces* 10, 24627–24637 (2018)
- [1] M. Han, Y. Wang, **D. Ma**, et al. “Coexistence of rhombohedral and orthorhombic phases in ultrathin BiFeO₃ films driven by interfacial oxygen octahedral coupling.” *Acta Materialia* 145, 220–226 (2018)

CONFERENCES/WORKSHOPS

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| July. 2025 | C06.3. Emittance Minimization for Aberration Correction via Machine Learning and Bayesian Optimization
<i>Microscopy & Microanalysis 2025 Meeting, July 27-July 31, Salt Lake City, UT, US</i> |
| Mar. 2025 | MAR-S39. Physics-informed Bayesian Optimization of an Electron Microscope
<i>APS March Meeting 2025, March 15-22, Los Angeles, CA, US</i> |
| July. 2024 | C01.3. Information Limit and Dose Efficiency of Electron Ptychography
<i>Microscopy & Microanalysis 2024 Meeting, July 28-August 1, Cleveland, OH, US</i> |
| July. 2023 | C01.2. Physics-informed Bayesian Optimization of an Electron Microscope |

	<i>Microscopy & Microanalysis 2023 Meeting, July 23-27, Minneapolis, MN, US</i>
Mar. 2023	Abstract: A45.00007 : Physics-informed Bayesian Optimization of an Electron Microscope <i>APS (American Physical Society) March Meeting 2023, March 5-10, Las Vegas, NV, US</i>
Nov. 2022	Physics-informed Bayesian optimization of an electron microscope <i>MIT.nano workshop: Automation, AI and Machine Learning in Electron Microscopy: Current Trends and Future Developments, Boston, MA, US</i>
Nov. 2022	Machine Learning for Beam Emittance Measurement and Aberration Correction of an Electron Microscope <i>3rd ICFA Beam Dynamics Mini-Workshop on Machine Learning Applications for Particle Accelerators, Chicago, IL, US</i>
Oct. 2022	SMRT: A Structural Model of Latent Ratings and Topics in Text <i>INFORMS Workshop on Data Science 2022, Indianapolis, IN, US</i> – Workshop on Data Science 2022 Student Scholarship <i>Conference on Information Systems and Technology (CIST) 2022, Indianapolis, IN, US</i> <i>The 17th INFORMS Workshop on Data Mining and Decision Analytics (DMDA), Indianapolis, IN, US</i> – Best Paper Finalist
June 2022	Automation of Electron Microscope Aberration Corrector Tuning* <i>The Center for Bright Beams Annual Meeting 2022, Los Angeles, CA, US</i>
June 2022	SMRT: A Structural Model of Latent Ratings and Topics in Text (Oral) <i>2022 Symposium on Data Science & Statistics (SDSS), Pittsburgh, PA, US</i>
Jan. 2021	Change Detection in Core-Periphery Networks: A Case Study on Detecting Financial Crises in the Interbank Market (Oral) <i>Cornell 2021 Day of Data, Ithaca, NY, US</i>
Mar. 2018	Abstract: A09.00003 : Evolution of a1/a2 Domains in Strained Ferroelectric Thin Films <i>APS (American Physical Society) March Meeting 2018, March 5-9, Los Angeles, CA, US</i>

TEACHING EXPERIENCE

2022 Spring	AEP 4340 Fluid and Continuum Mechanics
2021 Fall	AEM 4280 Valuation of Capital Investment
2021 Fall	AEP 3330 Mechanics of Particles and Solid Bodies
2021 Summer	NBA 6550 Introduction to SQL
2021 Summer	NCC 5060 Managerial Finance
2020 Spring	AEP 3200 Mathematical Physics
2019 Fall	AEP 1100 Lasers and Photonics

HONORS AND AWARDS

2022	3rd ICFA Beam Dynamics Mini-Workshop Student Scholarship	The Center for Bright Beams
2022	INFORMS Workshop on Data Science 2022 Student Scholarship	INFORMS
2018	Travel award to attend the APS March Meeting 2018	Nankai University
2017	Boling Class Fellowship	Nankai University

2016	First Prize in Nankai Physics Tournament	Nankai University
2015	Boling Class Freshman Fellowship	Nankai University

SKILLS

Programming Python, MATLAB, R, C++, SQL

Languages Mandarin (native), English (proficient), Japanese (intermediate)

PROFESSIONAL REFERENCES

Prof. David Muller

Cornell University, Ithaca, NY, USA

Email: dm24@cornell.edu

Prof. Jared Maxson

Cornell University, Ithaca, NY, USA

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