

Siddharth Maddali, Ph.D

Research Scientist (BBP Division)



NOTE: Icons are clickable links.

Education

Doctor of Philosophy (**Ph.D**) in *physics* (Carnegie Mellon University, 2016)

Master of Science (**M.S.**) in *physics* (Carnegie Mellon University, 2010)

Master of Science (**M.Sc**) in *physics* (Indian Institute of Technology Madras, 2009)

Bachelor of Science (**B.Sc**) in *physics , mathematics , electronics* (Bangalore University, 2007)

Experience

Research Scientist, KLA Corp. (KLA-Tencor)

Broadband Plasma (BBP) division, **Nov 2022 - present**

Assistant Scientist, Argonne National Laboratory

Synchrotron Radiation Studies of Materials group, **_Oct 2019 - Oct 2022**

Post-doctoral researcher, Argonne National Laboratory

Coherent diffraction imaging of materials structure, **Jan 2017 - Sept 2019**

Post-doctoral researcher, National Energy Technology Laboratory

Materials discovery with machine learning, **May 2016 - Sept 2016**

Graduate research assistant, Carnegie Mellon University

Department of Physics, **2012 - May 2016**

Graduate teaching assistant, Carnegie Mellon University

Department of Physics, **2009 - 2012**

Intern, National University of Singapore

Department of Physics, **May 2008**

Research interests

Optics/imaging:

Metrology, anomaly detection

Coherent diffraction imaging (CDI) of tensor fields

Coherent dark-field x-ray microscopy (DFXM)

High-energy x-ray diffraction microscopy (HEDM)

Multiscale characterization with x-ray & other light probes

X-ray photon correlation spectroscopy (XPCS), dynamic light scattering (DLS)

Condensed matter physics:

Light-matter interaction
Crystallography
Meso/nanoscale structure & strain
Interfacial dynamics in polycrystals

Computational methods:

Electromagnetic simulations
Inverse problems, phase retrieval
Signal processing and optimization
Data science, machine learning, reinforcement learning -based experimental control
High-performance computing and scientific software development

Presentations (☐ = link to accepted abstract)

Invited (presenter)

- 1) Advanced Photon Source Scientific Computation Seminar, Argonne National Laboratory, Lemont, IL (March 2022) ☐
- 2) Materials Science Division Colloquium, Argonne National Laboratory, Lemont, IL (October 2021) ☐
- 3) Workshop on *Advanced Probes & Data Analytics for Enabling Single-Pulse Imaging under Dynamic Conditions*, Santa Fe, NM (August 2019)
- 4) The Minerals, Metals and Materials Society (TMS), San Antonio, TX (March 2019) ☐
- 5) LANS seminar series, Mathematics & Computer Science Division, Argonne National Laboratory, Lemont, IL (Sept 2018) ☐
- 6) Department of physics, Carnegie Mellon University, Pittsburgh, PA (May 2018)

Select contributed (presenter)

- 1) Gordon X-ray Science Seminar, Easton, MA (July-August 2019: seminar & poster; July-August 2017: discussion leader)
- 2) Coherence: International workshop on phase retrieval and coherent scattering, Port Jefferson, NY (June 2018)
- 3) Materials Research Society Spring Meeting & Exhibit, Phoenix, AZ (April 2018) ☐
- 4) The Minerals, Metals and Materials Society (TMS), Orlando, FL (March 2015: Poster)
- 5) Materials Science and Technology (MS&T), Pittsburgh, PA (October 2014: seminar; October 2012: poster)

Miscellaneous (co-author)

- 1) The Minerals, Metals and Materials Society (TMS) 2023, San Diego, CA, 2023. ☐
- 2) The American Physical Society (APS) March Meeting, Chicago, IL, 2022. ☐
- 3) The Materials Research Society (MRS) Spring Meeting & Exhibit, Phoenix, AZ, 2018. ☐
- 4) The American Physical Society (APS) March Meeting, New Orleans, LA, 2017. ☐ ☐

Awards and honors

Oak Ridge Institute for Science and Education (ORISE) post-doctoral fellowship (2016)
The Indian Institute of Technology Madras Merit Scholarship (2007-2009)
Bangalore University overall rank 5 (2007)

Research grants

ANL LDRD 2021-0012: *Coherence-enhanced dark-field imaging for structural heterogeneity in materials*

Role: Principal investigator

Funding: Argonne LDRD (Laboratory Directed Research and Development) program

Period: 1st Oct 2020 — 30th Sept 2023 (3 years)

Amount: \$900,000

ANL LDRD 2019-0042: *Finding Critical Processes of Deformation in Structural Materials with Artificial Intelligence*

Role: Principal investigator

Funding: Argonne LDRD (Laboratory Directed Research and Development) program

Period: 1st Oct 2020 — 30th Sept 2021 (1 year)

Amount: \$100,000

Professional activity

Society membership

Americal Physical Society (APS), Materials Research Society (MRS), The Minerals, Metals and Materials Society (TMS)

Editorial

Aug 2021 — present: Guest editor for *MDPI: Crystals* special issue: *Synchrotron studies of materials*.



Peer review



US Department of Energy: Basic Energy Sciences (BES) Program, *Philosophical Magazine*, *Computational Materials Science*, *New Journal of Physics*, *Optics Letters*, *Physical Review X*, *Crystal Research and Technology*, *Journal of Applied Physics*, *Physical Review Letters*, *Physical Review B*, *IUCr Journal of Synchrotron Radiation*, *Optics Express*, *Journal of Applied Crystallography*, *Integrating Materials and Manufacturing Innovation*

Organization




- 1) Workshop (Session chair): *Dark field x-ray microscopy for mesoscale phenomena in ordered materials at APS-U*: APS/CNM Users Meeting, Lemont, IL, USA (May 2022)
- 2) Workshop: *Advances in Phase Retrieval Methods for High-Resolution X-ray Imaging*, APS/CNM Users Meeting, Argonne National Laboratory, Lemont, IL, USA (August 2020)
- 3) Workshop: *Advanced Probes and Data Analytics for Enabling Single Pulse Imaging Under Dynamic Conditions*, Santa Fe, NM, USA (August 2019)



Technical reports




[1] R. Pokharel, C. Bolme, J. Bohon, A. Mandal, D. Pagan, F. Hofmann, **S. Maddali**, A. Rack, *Advanced probes and data analytics for enabling 3-D imaging under dynamic conditions* **LAUR-19-31832**, **Los Alamos National Laboratory**, 2019.  

[2] N. Krishnamurthy, **S. Maddali**, A. Verma, L. Bruckman, J. Carter, R. French, V. Romanov, J. Hawk, *Data analytics for alloy qualification*, **NETL-PUB-21550**, **National Energy technology Laboratory**, 2017.  

References


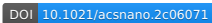




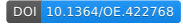

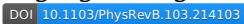

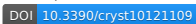


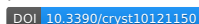












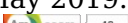
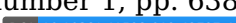
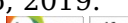


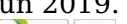


Dr. Stephan O. Hruszkewycz   
Supervisor
Synchrotron Studies of Materials
Materials Science Division
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Dr. Robert M. Suter  
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Department of physics
Carnegie Mellon University
Pittsburgh, PA (USA)

Dr. Anthony D. Rollett   
Collaborator, materials science

Dr. Marc Allain  
Collaborator, computation/mathematics

Publications

- [1] **S. Maddali**, T.D. Frazer, N. Deegan, K.J. Harmon, S.E. Sullivan, M. Allain, W. Cha, A. Dibos, I. Poudyal, S. Kandel, Y.S.G. Nashed, F.J. Heremans, H. You, Y. Cao and S.O. Hruszkewycz, *Concurrent multi-peak Bragg coherent x-ray diffraction imaging of 3D nanocrystal lattice displacement via global optimization*, **npj Computational Materials** (in press), April 2023.

- [2] M.O. Hill, P. Schmiedeke, C. Huang, **S. Maddali**, X. Hu, S.O. Hruszkewycz, J.J. Finley, G. Koblmüller and L.J. Lauhon, *3D Bragg Coherent Diffraction Imaging of Extended Nanowires: Defect Formation in Highly Strained InGaAs Quantum Wells*, **ACS Nano**, vol. , number , pp. , Nov 2022.
 
- [3] N. Bertaux, M. Allain, J. Weizeorick, J.-. Park, P. Kenesei, S.D. Shastri, J. Almer, M.J. Highland, **S. Maddali** and S.O. Hruszkewycz, *Sub-pixel high-resolution imaging of high-energy x-rays inspired by sub-wavelength optical imaging*, **Opt. Express**, vol. 29, number 22, pp. 35003--35021, Oct 2021.
 
- [4] S. Kandel, **S. Maddali**, Y.S.G. Nashed, S.O. Hruszkewycz, C. Jacobsen and M. Allain, *Efficient ptychographic phase retrieval via a matrix-free Levenberg-Marquardt algorithm*, **Opt. Express**, vol. 29, number 15, pp. 23019--23055, Jul 2021.
  
- [5] M.J. Wilkin, **S. Maddali**, S.O. Hruszkewycz, A. Pateras, R.L. Sandberg, R. Harder, W. Cha, R.M. Suter and A.D. Rollett, *Experimental demonstration of coupled multi-peak Bragg coherent diffraction imaging with genetic algorithms*, **Phys. Rev. B**, vol. 103, number , pp. 214103, Jun 2021.
 
- [6] Y. Cao, D. Sheyfer, Z. Jiang, **S. Maddali**, H. You, B.X. Wang, Z.G. Ye, E.M. Dufresne, H. Zhou, G.B. Stephenson and S.O. Hruszkewycz, *The Effect of Intensity Fluctuations on Sequential X-ray Photon Correlation Spectroscopy at the X-ray Free Electron Laser Facilities*, **Crystals**, vol. 10, number 12, pp. 1109, December 2020.
 
- [7] **S. Maddali**, M. Allain, P. Li, V. Chamard and S.O. Hruszkewycz, *Detector Tilt Considerations in Bragg Coherent Diffraction Imaging: A Simulation Study*, **Crystals**, vol. 10, number 12, pp. 1150, December 2020.
  
- [8] **S. Maddali**, J. Park, H. Sharma, S. Shastri, P. Kenesei, J. Almer, R. Harder, M.J. Highland, Y. Nashed and S.O. Hruszkewycz, *High-Energy Coherent X-Ray Diffraction Microscopy of Polycrystal Grains: Steps Toward a Multiscale Approach*, **Phys. Rev. Applied**, vol. 14, number , pp. 024085, Aug 2020.
  
- [9] **S. Maddali**, P. Li, A. Pateras, D. Timbie, N. Deegan, A.L. Crook, H. Lee, I. Calvo-Almazan, D. Sheyfer, W. Cha, F.J. Heremans, D.D. Awschalom, V. Chamard, M. Allain and S.O. Hruszkewycz, *General approaches for shear-correcting coordinate transformations in Bragg coherent diffraction imaging. Part I*, **Journal of Applied Crystallography**, vol. 53, number 2, pp. , Apr 2020.
  
- [10] P. Li, **S. Maddali**, A. Pateras, I. Calvo-Almazan, S. Hruszkewycz, W. Cha, V. Chamard and M. Allain, *General approaches for shear-correcting coordinate transformations in Bragg coherent diffraction imaging. Part II*, **Journal of Applied Crystallography**, vol. 53, number 2, pp. , Apr 2020.
  
- [11] **S. Maddali**, M. Allain, W. Cha, R. Harder, J. Park, P. Kenesei, J. Almer, Y. Nashed and S.O. Hruszkewycz, *Phase retrieval for Bragg coherent diffraction imaging at high x-ray energies*, **Phys. Rev. A**, vol. 99, number , pp. 053838, May 2019.
  
- [12] I. Calvo-Almazan, M. Allain, **S. Maddali**, V. Chamard and S.O. Hruszkewycz, *Impact and mitigation of angular uncertainties in Bragg coherent x-ray diffraction imaging*, **Scientific Reports**, vol. 9, number 1, pp. 6386, 2019.
 
- [13] S. Kandel, **S. Maddali**, M. Allain, S.O. Hruszkewycz, C. Jacobsen and Y. Nashed, *Using automatic differentiation as a general framework for ptychographic reconstruction*, **Opt. Express**, vol. 27, number 13, pp. 18653--18672, Jun 2019.
  
- [14] N. Krishnamurthy, **S. Maddali**, J.A. Hawk and V.N. Romanov, *9Cr steel visualization and predictive modeling*, **Computational Materials Science**, vol. , number , pp. , 2019.
 

[15] Y. Shen, **S. Maddali**, D. Menasche, A. Bhattacharya, G.S. Rohrer and R.M. Suter, *Importance of outliers: A three-dimensional study of coarsening in α -phase iron*, **Phys. Rev. Materials**, vol. 3, number , pp. 063611, Jun 2019.

DOI [10.1103/PhysRevMaterials.3.063611](https://doi.org/10.1103/PhysRevMaterials.3.063611)

Am score { 1

[16] A. Ulvestad, S.O. Hruszkewycz, M.V. Holt, M.O. Hill, I. Calvo-Almazan, **S. Maddali**, X. Huang, H. Yan, E. Nazaretski, Y.S. Chu, L.J. Lauhon, N. Rodkey, M.I. Bertoni and M.E. Stuckelberger, *Multimodal X-ray imaging of grain-level properties and performance in a polycrystalline solar cell*, **Journal of Synchrotron Radiation**, vol. 26, number 4, pp. , Jul 2019.

DOI [10.1107/S1600577519003606](https://doi.org/10.1107/S1600577519003606)

Am score { 1

[17] I. Calvo-Almazan, A.P. Ulvestad, E. Colegrove, T. Ablekim, M.V. Holt, M.O. Hill, **S. Maddali**, L.J. Lauhon, M.I. Bertoni, X. Huang, H. Yan, E. Nazaretski, Y.S. Chu, S.O. Hruszkewycz and M.E. Stuckelberger, *Strain Mapping of CdTe Grains in Photovoltaic Devices*, **IEEE Journal of Photovoltaics**, vol. , number , pp. 1-10, 2019.

DOI [10.1109/JPHOTOV.2019.2942487](https://doi.org/10.1109/JPHOTOV.2019.2942487)

Am score { 1

[18] A. Ulvestad, W. Cha, I. Calvo-Almazan, **S. Maddali**, S.M. Wild, E. Maxey, M. Dupraz and S.O. Hruszkewycz, *Bragg Coherent Modulation Imaging: Strain- and Defect- Sensitive Single Views of Extended Samples*, 2018

preprint [arXiv:1808.00115](https://arxiv.org/abs/1808.00115)

[19] **S. Maddali**, I. Calvo-Almazan, J. Almer, P. Kenesei, J. Park, R. Harder, Y. Nashed and S.O. Hruszkewycz, *Sparse recovery of undersampled intensity patterns for coherent diffraction imaging at high X-ray energies*, **Scientific Reports**, vol. 8, number 1, pp. 4959, 2018.

preprint [arXiv:1712.01108](https://arxiv.org/abs/1712.01108)

DOI [10.1038/s41598-018-23040-y](https://doi.org/10.1038/s41598-018-23040-y)

Am score { 0

[20] S.O. Hruszkewycz, **S. Maddali**, C.P. Anderson, W. Cha, K.C. Miao, M.J. Highland, A. Ulvestad, D.D. Awschalom and F.J. Heremans, *Strain annealing of SiC nanoparticles revealed through Bragg coherent diffraction imaging for quantum technologies*, **Phys. Rev. Materials**, vol. 2, number , pp. 086001, Aug 2018.

DOI [10.1103/PhysRevMaterials.2.086001](https://doi.org/10.1103/PhysRevMaterials.2.086001)

Am score { 0

[21] M.J. Highland, S.O. Hruszkewycz, D.D. Fong, C. Thompson, P.H. Fuoss, I. Calvo-Almazan, **S. Maddali**, A. Ulvestad, E. Nazaretski, X. Huang, H. Yan, Y.S. Chu, H. Zhou, P.M. Baldo and J.A. Eastman, *In-situ synchrotron x-ray studies of the microstructure and stability of In₂O₃ epitaxial films*, **Applied Physics Letters**, vol. 111, number 16, pp. 161602, 2017.

DOI [10.1063/1.4997773](https://doi.org/10.1063/1.4997773)

Am score { 1

[22] **S. Maddali**, S. Ta'asan and R.M. Suter, *Topology-faithful nonparametric estimation and tracking of bulk interface networks*, **Computational Materials Science**, vol. 125, number , pp. 382--340, 2016.

preprint [arXiv:1601.04698](https://arxiv.org/abs/1601.04698)

DOI [10.1016/j.commatsci.2016.08.021](https://doi.org/10.1016/j.commatsci.2016.08.021)

Am score { 1

[23] L. Renversade, R. Quey, W. Ludwig, D. Menasche, **S. Maddali**, R.M. Suter and A. Borbely, *Comparison between diffraction contrast tomography and high-energy diffraction microscopy on a slightly deformed aluminium alloy*, **IUCrJ**, vol. 3, number 1, pp. 32--42, 2016.

DOI [10.1107/S2052252515019995](https://doi.org/10.1107/S2052252515019995)

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