

# Dr. Siddharth Maddali

**Assistant Scientist (Materials Science Division)**



## 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

**Assistant Scientist**, Argonne National Laboratory

Synchrotron Radiation Studies of Materials group, **Oct 2019 - present**

**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**

# Research interests

## **X-ray sciences (imaging and characterization):**

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 probes  
X-ray photon correlation spectroscopy (XPCS)

## **Condensed matter physics:**

Mesoscale/nanoscale structure and lattice strain  
Interfacial dynamics in polycrystals

## **Computational methods in physics:**

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

## **Invited**

- 1) Workshop on *Advanced probes and data analytics for enabling single-pulse imaging under dynamic conditions*, Santa Fe, NM (August 2019)
- 2) The Minerals, Metals and Materials Society (TMS), San Antonio, TX (March 2019)
- 3) Department of physics, Carnegie Mellon University, Pittsburgh, PA (May 2018)

## **Select contributed**

- 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, 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)

## 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:** 1<sup>st</sup> Oct 2020 — 30<sup>th</sup> Sept 2021 (1 year)

**Amount:** \$300,000

**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:** 1<sup>st</sup> Oct 2020 — 30<sup>th</sup> 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

**Jan 2020 — present:** Topics editor for *MDPI: Crystals*

*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*

## Organization

- 1) Workshop: *Advances in Phase Retrieval Methods for High-Resolution X-ray Imaging* , APS/CNM Users Meeting, Argonne National Laboratory, Lemont, IL (August 2020)
- 2) Workshop: *Advanced Probes and Data Analytics for Enabling Single Pulse Imaging Under Dynamic Conditions* , Santa Fe, NM (August 2019)

## Conference proceedings

- [1] Krishnamurthy, N., **Maddali, S.**, Romanov, V. & Hawk, J., *Predictive analysis of the influence of the chemical composition and pre-processing regimen on structural properties of steel alloys using machine learning techniques. Bulletin of the American Physical Society*, APS, 2017, 62 (abstract)
- [2] Krishnamurthy, N., **Maddali, S.**, Romanov, V. & Hawk, J., *Segmentation of 9Cr Steel Samples based on Composition and Mechanical Property. Bulletin of the American Physical Society*, APS, 2017, 62 (abstract)

## Publications

- [1] (**Under review**) Bertaux N., Allain M., Weizeorick J., Park J.- S., Kenesei P., Shastri S. D., Almer J., Highland M. J., **Maddali S.** and Hruszkewycz S. O., *Sub-pixel high-resolution imaging of high-energy x-rays by sub-wavelength optical imaging*, 2021.
- [2] (**Under review**) Kandel S., **Maddali S.**, Nashed Y. S. G., Hruszkewycz S. O., Jacobsen C. and Allain Marc, *A matrix-free Levenberg-Marquardt algorithm for efficient ptychographic phase retrieval*, 2021.
- [3] Cao Y., Sheyfer D., Jiang Z., **Maddali S.**, You H., Wang B. X., Ye Z. G., Dufresne E. M., Zhou H., Stephenson G. B. and Hruszkewycz S. O.,

*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. [online](#)

[4] **Maddali S.**, Allain M., Li P., Chamard V. and Hruszkewycz S. O., *Detector Tilt Considerations in Bragg Coherent Diffraction Imaging: A Simulation Study*, **Crystals**, vol. 10, number 12, pp. 1150, December 2020. [online](#)

[5] **Maddali S.**, Park J.-S., Sharma H., Shastri S., Kenesei P., Almer J., Harder R., Highland M. J., Nashed Y. and Hruszkewycz S. O., *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. [online](#)

[6] **Maddali S.**, Li P., Pateras A., Timbie D., Delegan N., Crook A. L., Lee H., Calvo-Almazan I., Sheyfer D., Cha W., Heremans F. J., Awschalom D. D., Chamard V., Allain M. and Hruszkewycz S. O., *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. [online](#)

[7] Li P., **Maddali S.**, Pateras A., Calvo-Almazan I., Hruszkewycz S.O., Cha W., Chamard V. and Allain M., *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. [online](#)

[8] **Maddali S.**, Allain M., Cha W., Harder R., Park J.-S., Kenesei P., Almer J., Nashed Y. and Hruszkewycz S. O., *Phase retrieval for Bragg coherent diffraction imaging at high x-ray energies*, **Phys. Rev. A**, vol. 99, number , pp. 053838, May 2019. [online](#)

[9] Calvo-Almazan I., Allain M., **Maddali S.**, Chamard V. and Hruszkewycz S. O., *Impact and mitigation of angular uncertainties in Bragg coherent x-ray diffraction imaging*, **Scientific Reports**, vol. 9, number 1, pp. 6386, 2019. [online](#)

[10] Kandel S., **Maddali S.**, Allain M., Hruszkewycz S. O., Jacobsen C. and Nashed Y., *Using automatic differentiation as a general framework for ptychographic reconstruction*, **Opt. Express**, vol. 27, number 13, pp. 18653-18672, Jun 2019. [online](#)

[11] Krishnamurthy N., **Maddali S.**, Hawk J. A. and Romanov V. N., *9Cr steel visualization and predictive modeling*, **Computational Materials**

[12] Shen Yu-Feng, **Maddali S.**, Menasche D., Bhattacharya A., Rohrer G. S. and Suter R. M., *Importance of outliers: A three-dimensional study of coarsening in  $\alpha$ -phase iron*, **Phys. Rev. Materials**, vol. 3, number , pp. 063611, Jun 2019. [online](#)

[13] Ulvestad A., Hruszkewycz S. O., Holt M. V., Hill M. O., Calvo-Almazan I., **Maddali S.**, Huang X., Yan H., Nazaretski E., Chu Y. S., Lauhon L. J., Rodkey N., Bertoni M. I. and Stuckelberger M. E., *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. [online](#)

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

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

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

[17] Highland M. J., Hruszkewycz S. O., Fong D. D., Thompson C, Fuoss P. H., Calvo-Almazan I., **Maddali S.**, Ulvestad A., Nazaretski E., Huang X., Yan H., Chu Y. S., Zhou H., Baldo P. M. and Eastman J. A., *In-situ synchrotron x-ray studies of the microstructure and stability of In<sub>2</sub>O<sub>3</sub> epitaxial films*, **Applied Physics Letters**, vol. 111, number 16, pp. 161602, 2017. [online](#)

[18] N. Krishnamurthy, **S. Maddali**, A. Verma, L. Bruckman, J. Carter, R. French, V. Romanov and J. Hawk, *Data analytics for alloy qualification*, **National Energy technology Laboratory**, number: NETL-PUB-21550, 2017. [online](#)

[19] **Maddali S.**, Ta'asan S. and Suter R. M., *Topology-faithful*

*nonparametric estimation and tracking of bulk interface networks*,  
**Computational Materials Science**, vol. 125, number , pp. 382–340,  
2016. [online](#)

[20] Renversade L., Quey R., Ludwig W., Menasche D., **Maddali S.**,  
Suter R. M. and Borbely A., *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.  
[online](#)

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