Siddharth Maddali, Ph.D

Computational scientist/engineer

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siddharthmaddali

Experience

- **Independent** — **Fremont, CA, USA**
  - **Scientific Consultant** — Feb 2024 – present
    - Provided technical consulting for investors in emerging semiconductor technologies.
    - Built an AI-powered dashboard for automated land area survey trained on drone-based multi-spectral images.
- **KLA Corporation (KLA-Tencor)** — **Milpitas, CA, USA**
  - **Research Scientist** — Nov 2022 – Jan 2024
    - Developed methods for sensitivity enhancement in semiconductor wafer inspection processes.
- **Argonne National Laboratory** — **Chicago, IL, USA**
  - **Staff Scientist** — Oct 2019 – Sep 2022
    1. Led the computational development and worked on the **first demonstration** of the X-ray MR-BCDI imaging technique.
    2. Led the design of future imaging experiments at DoE facilities with physics-based signal processing techniques.
    3. Led the multi-scale X-ray diffraction imaging approach for materials in difficult-to-access environments.
    4. Raised $900k seed funding for computational R&D and novel microscopy infrastructure.
    5. Proposed, executed novel proofs of concept in materials research (US, France).
    6. Published work in high-impact scientific journals, mentored junior researchers, organized/chaired international workshops.
  - **Postdoctoral researcher** — Jan 2017 – Sep 2019
    1. **First demonstration** of multi-scale, high-energy coherent diffraction imaging (HEDM) of 3D materials.
- **National Energy Technology Laboratory** — **Pittsburgh, PA, USA**
  - **Postdoctoral Researcher**: ORISE Fellow — May 2016 – Nov 2016
    1. Developed guidelines for machine learning-driven materials discovery of novel, function-optimized alloys.
- **Carnegie Mellon University** — **Pittsburgh, PA, USA**
  - **Graduate teaching/research assistant** — Aug 2009 – Feb 2016
    1. Dissertation on mining meso-scale materials physics from high-energy synchrotron data.
    2. Created HierarchicalSmooth: mesh smoothing software for physical interface networks.
    3. Taught mechanics & electromagnetism to undergraduate science majors.

Education

- **Ph.D**, & **M.S.**, Physics (Dissertation area: materials science) — **Pittsburgh, PA, USA**
  — *Carnegie Mellon University* — Aug 2009 – Feb 2016
- **M.Sc**, Physics — **Chennai, TN, India**
  — *Indian Institute of Technology Madras (IIT-M)* — Aug 2007 – May 2009
- **B.Sc**, Physics, mathematics, electronics — **Bengaluru, KA, India**
  — *Bangalore University* — June 2004 – May 2007

Technical skills

- **AI/ML**: LLMs, retrieval augmented generation (RAG), data science, applied statistics, machine learning, deep learning for computer vision, CNNs, prompt engineering
- **Software**: Python scientific stack (numpy, scipy, matplotlib, scikit-learn, pandas + more), Matlab, Linux, git, bash, LaTeX, HPC + parallel computing (MPI), GPU development, PyTorch, Tensorflow, C++, Docker, Qiskit
- **Math/computation**: Linear algebra, imaging + reconstruction, optimization, signal processing, inverse problems, simulations, statistics, probability, FDTD (meep), RCWA, computational geometry, differential equations
- **Science**: Geometric + Fourier optics, microscopy, X-ray science, condensed matter + materials physics, electromagnetics, mechanics, statistical physics, semiconductors, experimental design, quantum sciences

Awards & Grants

1. ANL LDRD Research grant: *Coherence-enhanced dark-field X-ray microscopy* (Role: PI; $930,000).
2. ANL LDRD Research grant: *detecting critical microstructural processes with AI* (Role: PI; $100,000).
3. Oak Ridge Institute for Science & Education (ORISE) post-doctoral fellowship (2016).
4. Indian Institute of Technology Madras Academic Merit Scholarship (2007 – 2009).
5. IIT Joint Admission to M.Sc (IIT-JAM) All-india rank 5 (out of $\simeq$ 4000) (2007).
6. Bangalore University undergraduate rank 5 (2007).

Professional Activities & Outreach (link to full CV)

- **Editorship**: *Crystals* special issue: Synchrotron Studies of Materials
- **Select invited talks**: The Minerals, Metals, Materials Society (TMS), Advanced Photon Source.
- **Society membership**: American Physical Society, Materials Research Society, TMS.
- **Select peer review**: US Department of Energy, American Physical Society, Optica.
- **Select workshop organization**: Advanced Photon Source User Meetings.

Select publications (link to full CV)

1. **Maddali, S.**, Frazer, T.D., Delegan, N. *et al*, *Concurrent multi-peak Bragg coherent x-ray diffraction imaging of 3D nanocrystal lattice displacement via global optimization*, **npj Computational Materials** 9, 77 (2023).
2. Wilkin, M., **Maddali, S.**, Hruszkewycz, S., Pateras, A., Sandberg, R., Harder, R., Cha, W., Suter, R., & Rollett, A. *Experimental demonstration of coupled multi-peak Bragg coherent diffraction imaging with genetic algorithms*, **Phys. Rev. B**, 103, 214103. (2021).
3. **Maddali, S.**, Allain, M., Cha, W., Harder, R., Park, J.S., Kenesei, P., Almer, J., Nashed, Y., & Hruszkewycz, S., *Phase retrieval for Bragg coherent diffraction imaging at high x-ray energies*, **Phys. Rev. A**, 99, 053838 (2019).
4. **Maddali, S.**, Park, J.S., Sharma, H., Shastri, S., Kenesei, P., Almer, J., Harder, R., Highland, M., Nashed, Y., & Hruszkewycz, S., *High-Energy Coherent X-Ray Diffraction Microscopy of Polycrystal Grains: Steps Toward a Multiscale Approach*, **Phys. Rev. Appl.**, 14, 024085 (2020).
5. Kandel, S., **Maddali, S.**, Allain, M., Hruszkewycz, S. O., Jacobsen, C., & Nashed, Y. S. G., *Using automatic differentiation as a general framework for ptychographic reconstruction*, **Opt. Express**, 27(13):18653–18672 (2019).

Languages

English (fluent), Hindi (fluent), Tamil (intermediate), Telugu (intermediate), Marathi (intermediate), Kannada (intermediate), French (beginner)