Zehao Dong

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Profile

I am currently a PhD candidate in Physics at Tsinghua University. My research centers on strongly correlated quantum materials (nickelates, cuprates) and advanced electron microscopy. I develop computational imaging methods—particularly multislice electron ptychography (MEP) and tilt-coupled MEP—to visualize atomic defects and single dopants in 3D, and I have prior experience in STM/tunneling spectroscopy on superconductors.

Research Interests

- High-temperature superconductivity in cuprates and nickelates;
- Scanning transmission electron microscopy at atomic resolution
- Multislice electron ptychography; GPU-accelerated computational imaging and phase retrieval

Education

Tsinghua University, PhD in Physics 2022 – present

- Research: Electron ptychography (MEP), 4D-STEM, strongly correlated materials (nickelates/cuprates)
- Advisors: Prof. Yayu Wang; Prof. Zhen Chen

Peking University, BSc in Physics 2018 – 2022

Selected Publications

- **Interstitial oxygen order and its competition with superconductivity in $La_2PrNi_2O_{7+\delta}$** 2025

  Zehao Dong†, Gang Wang†, Ningning Wang†, Wen-Han Dong†, Lin Gu, Yong Xu, Jinguang Cheng*, Zhen Chen* & Yayu Wang*
  Nature Materials (2025), 10.1038/s41563-025-02351-2

- **Sub-nanometer depth resolution and single dopant visualization achieved by tilt-coupled multislice electron ptychography** 2025

  Zehao Dong, Yang Zhang, Chun-Chien Chiu, Sicheng Lu, Jianbing Zhang, Yu-Chen Liu, Suya Liu, Jan-Chi Yang, Pu Yu, Yayu Wang & Zhen Chen*
  Nature Communications, 16, 1219 (2025)

- **Visualization of oxygen vacancies and self-doped ligand holes in $La_3Ni_2O_{7-\delta}$** 2024

  Zehao Dong†, Mengwu Huo†, Jie Li†, Jingyuan Li, Pengcheng Li, Hualei Sun, Lin Gu, Yi Lu*, Meng Wang*, Yayu Wang* & Zhen Chen*
  Nature, 641, 70-75 (2024)

- **The emergence of global phase coherence from local pairing in underdoped cuprates** 2023

  Shusen Ye, Changwei Zou, Hongtao Yan, Yu Ji, Miao Xu, ***Zehao Dong***, Yiwen Chen, Xingjiang Zhou & Yayu Wang*
  Nature Physics, 19, 1301-1307 (2023)

- **Planar tunneling spectroscopy on van der Waals superconductors with AlO_x junction grown by ALD** 2023

  Yu Ji, Hao Wang, ***Zehao Dong***, Shusen Ye, Qingyang Li, Zhiting Gao, G. D. Gu, Zhenqi Hao, Yayu Wang*
  J. Appl. Phys., 133, 013903 (2023)

(For a complete and up-to-date list, please see my Google Scholar)

Research Experience

PhD Research, Tsinghua University, Department of Physics 2022 – present

- Developed GPU-accelerated multislice electron ptychography (MEP) pipelines.
- Introduced tilt-coupled MEP for sub-nanometer depth resolution and single-dopant 3D visualization.
- Applied 4D-STEM/MEP to nickelate superconductors to quantify oxygen vacancies, ligand holes, and interstitial oxygen ordering.
- Tools: MATLAB, Python; NVIDIA A100/RTX 4090 clusters; STEM and EELS.

Undergraduate Research, Peking University, School of Physics 2019 – 2022

- Fabricated ALD-grown AlO_x planar tunnel junctions for vdW superconductors.
- Low-T spectroscopy and angular magnetotransport.
- STM/tunneling spectroscopy on cuprates and conventional superconductors.

Fundings & Awards

- **NSFC's Young Student Program for Graduate Students** (Grant No. 124B2068) 2025 – 2026
- **National Scholarships**, China 2024 & 2025
- **Best Oral Presentation Award**, 20th International Microscopy Congress, Busan 2023
- **Gold Medalist**, 49th International Physics Olympiad (IPhO) 2018

Conference Presentations

- **CPS Fall Meeting, Harbin, China** 2025 (Poster)

  Interstitial oxygen order and its competition with superconductivity in $La_2PrNi_2O_{7+\delta}$

- **CPS Fall Meeting, Haikou, China** 2024 (Oral)

  Visualization of oxygen vacancies and self-doped ligand holes in $La_3Ni_2O_{7-\delta}$

- **Advanced Transmission Electron Microscopy Conference, Hong Kong, China** 2024 (Poster)

  Visualization of oxygen vacancies and self-doped ligand holes in $La_3Ni_2O_{7-\delta}$

- **20th International Microscopy Congress, Busan, South Korea** 2023 (Oral)

  Improving depth resolution using tilt-series coupled multislice electron ptychography

Technical Skills

- **Experimental:** STEM/4D-STEM, electron ptychography, EELS;
- **Programming:** MATLAB, Python; GPU computing
- **Languages:** Chinese (Native), English (Fluent)