Zehao Dong

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Profile

I am a Ph.D. candidate in Physics at Tsinghua University working at the intersection of strongly correlated materials, 4D-STEM, and computational imaging. I develop GPU-accelerated multislice electron ptychography methods for three-dimensional, atomic-scale imaging of defects and dopants in functional materials. I am expected to graduate in June 2027.

Research Interests

- Strongly correlated materials, including cuprate and nickelate superconductors
- Atomic-resolution scanning transmission electron microscopy and 4D-STEM
- Multislice electron ptychography, computational imaging, and GPU-accelerated phase retrieval

Education

- **Tsinghua University**, Ph.D. in Physics; Advisor: Yayu Wang 2022 – 2027
- **Peking University**, B.S. in Physics 2018 – 2022

Publication list

- **Visualization of oxygen vacancies and self-doped ligand holes in $La_3Ni_2O_{7-\delta}$** 2024
  Dong, Z.†, Huo, M.†, Li, J.†, Li, J., Li, P., Sun, H., *et al. Nature* **630**, 847–852.
- **Interstitial oxygen order and its competition with superconductivity in $La_2PrNi_2O_{7+\delta}$** 2025
  Dong, Z.†, Wang, G.†, Wang, N.†, Dong, W.-H.†, *et al. Nature Materials* **24**, 1927–1934.
- **Sub-nanometer depth resolution and single dopant visualization achieved by tilt-coupled multislice electron ptychography** 2025
  Dong, Z., Zhang, Y., Chiu, C.-C., Lu, S., Zhang, J., Liu, Y.-C., *et al. Nature Communications* **16**, 1219.
- **Atomic-scale quantification of hydrogen in metal hydrides by electron ptychography** 2026
  Li, P.†, Pua, C.†, **Dong, Z.**, Su, Z., Liu, T., Cai, C., *et al. Science Advances* **12**, eaed5872.
- **Distinct orbital contributions to electronic and magnetic structures in $La_4Ni_3O_{10}$** 2026
  Zhang, S.†, Zhang, H.†, **Dong, Z.**, Li, J., Xiao, Q., Huo, M., *et al. Physical Review Research* **8**, 023119.
- **Visualization of the Zhang–Rice singlet, electronic molecules and Cooper pair formation in a cuprate superconductor** 2026
  Ye, S., Zhao, J., Yao, Z., Chen, S., Yu, R., **Dong, Z.**, *et al. Nature Physics* (2026).
- **The emergence of global phase coherence from local pairing in underdoped cuprates** 2023
  Ye, S., Zou, C., Yan, H., Ji, Y., Xu, M., **Dong, Z.**, *et al. Nature Physics* **19**, 1301–1307.
- **Multi-state data storage in a two-dimensional stripy antiferromagnet implemented by magnetoelectric effect** 2023
  Gu, P., Wang, C., Su, D., **Dong, Z.**, Wang, Q., Han, Z., *et al. Nature Communications* **14**, 3221.
- **Planar tunneling spectroscopy on van der Waals superconductors with AlO_x junction grown by atomic layer deposition** 2023
  Ji, Y., Wang, H., **Dong, Z.**, Ye, S., Li, Q., Gao, Z., *et al. Journal of Applied Physics* **133**, 013903.

Selected Funding & Awards

- **Gold Medalist**, 49th International Physics Olympiad (**IPhO**) 2018
- **Best Oral Presentation Award**, 20th International Microscopy Congress 2023

- **National Scholarship for Graduate Students**, Ministry of Education, China 2024 & 2025
- **NSFC's Fund for Graduate Students** 2025 – 2026

Conference Oral Presentations

- **21th International Microscopy Congress, Liverpool, UK** 2026
  Quantification of oxygen vacancies and interstitials in bilayer nickelate superconductors using electron ptychography
- **Materials & Mechanisms of Superconductivity Conference, Stuttgart, Germany** 2026
  Visualizing oxygen vacancies and interstitials in bilayer nickelates via electron ptychography
- **Chinese Physical Society Fall Meeting, Haikou, China** 2024
  Visualization of oxygen vacancies and self-doped ligand holes in $La_3Ni_2O_{7-\delta}$
- **20th International Microscopy Congress, Busan, South Korea** 2023
  Improving depth resolution using tilt-series coupled multislice electron ptychography

Technical Skills

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