Zhizheng Zhao

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EDUCATION

Peking University **Expected 07/2026**

B.S. in Physics (School of Physics)

- **GPA:** 83.7/100 (3.5/4.0)

ACADEMIC VISITS

Shenzhen International Quantum Academy *01/2025 – 02/2025*

AWARDS

Alishan Scholarship *8/261 recipients, 09/2025*
Outstanding Research Award *30/261 recipients, 09/2025*
National Endeavor Scholarship *09/2025*

PUBLICATIONS

Let's Verify and Reinforce Image Generation Step by Step **CVPR 2025**

Renrui Zhang*, Chengzhuo Tong*, **Zhizheng Zhao***, Ziyu Guo*, Huaidong Zhang, Manyuan Zhang, Peng Gao, Hongsheng Li

(Co-first authorship)*

RESEARCH EXPERIENCE

Reward and Policy Distribution Optimization in GRPO **03/2025 – 07/2025**

University of Illinois Urbana-Champaign (UIUC) | Advisor: Prof. Minjia Zhang

Conducted a comprehensive analysis of Group-Based Reward Policy Optimization (GRPO), structuring the investigation into two primary technical thrusts:

- **Part 1: Enhancing Advantage Granularity** (Addressing coarse sample-level feedback)
  - *Token-Level Critic:* Designed a critic model to learn token "vitality" ($b_\phi(t)$), attempting to assign fine-grained credit to critical tokens within a sample.
  - *Probability Compensation:* Developed a mechanism to amplify gradients for "rare gems" (high-reward but low-probability samples) to accelerate learning from sparse signals.
- **Part 2: Addressing Distribution Mismatch** (Solving the "All-Fail" group phenomenon)
  - *Resource Re-allocation:* Experimented with culling "solved" prompts to concentrate computational budget on hard instances (Concentration of Force).
  - *Negative Advantage:* Proposed explicitly suppressing consistent failure regions by assigning negative rewards to zero-gradient groups (validating NGRPO concepts).
  - *Dense Reward Shaping:* Explored replacing binary rewards with Ground Truth Likelihood to guide reasoning chains in mathematical tasks.

Chain-of-Thought Reasoning for Advanced Image Generation **09/2024 – 01/2025**

CUHK & ByteDance | Advisor: Dr. Renrui Zhang

- Applied **Chain-of-Thought (CoT)** strategies to autoregressive text-to-image generation, integrating Direct Preference Optimization (DPO) to enhance reasoning capabilities.
- Independently proposed and developed the **Potential Assessment Reward Model (PARM)**. This model adaptively evaluates intermediate generation steps to select high-potential reasoning paths, balancing test-time compute efficiency with performance.

- Enhanced the *Show-o* model, achieving a **+24% improvement on GenEval** and surpassing Stable Diffusion 3 by **+15%** in benchmark performance.

Improving Crystal Structure Prediction via Niggli Reduction **07/2025 – 09/2025**

The Chinese University of Hong Kong (CUHK) | Advisor: Prof. Shengchao Liu

- Identified a fundamental theoretical limitation in the state-of-the-art **DiffCSP** framework: reliance on E(3) equivariance fails to account for **lattice basis transformation invariance**.
- Proposed a principled framework incorporating **Niggli reduction** to align predictions with canonical lattice representations, effectively closing the theoretical gap.
- Designed a **differentiable Proxy Loss** to enable effective training on these canonical representations, significantly improving the physical validity of predicted crystal structures.

Resistive Plate Counter Development **03/2024 – 07/2024**

Peking University | Advisor: Prof. Qite Li

- Assembled and commissioned a Resistive Plate Counter (RPC) detector for high-energy physics experiments.
- Developed signal processing pipelines and feature extraction algorithms for precise Particle Identification (PID).

SELECTED COURSE PROJECTS

Neural Network Solver for Electric Fields **12/2024**

Course: Physics and AI | Advisor: Prof. Yanqing Ma

- Implemented a **Physics-Informed Neural Network (PINN)** to solve complex electric field distributions.
- Designed custom loss functions integrating boundary conditions and PDE residuals to approximate physical solutions.

SKILLS

Languages	Python, LaTeX, CERN ROOT
Tools	PyTorch, Git, Linux Environments