# **Candi ZHENG** Candi ZHENG • Scraed.github.io

## Education

- Post Doctoral Researcher, Dec 2024 Now
  The Hong Kong University of Science and Technology
- Ph.D. in Mathematics, Feb 2019 Oct 2024
  The Hong Kong University of Science and Technology (Supervisor: Professor Yang Wang)
- Ph.D. in Mechanical and Aerospace Engineering, Sep 2017 Feb 2019
  The Hong Kong University of Science and Technology (Supervisor: Professor Yang Wang)
- Joint Ph.D. in Mechanical and Aerospace Engineering, Feb 2017 Oct 2024
  The Southern University of Science and Technology (Supervisor: Professor Shiyi Chen)
- Visiting Student, Sep 2016 Jan 2017
  The University of Edinburgh
- B.S. in Physics, Sep 2013 Jun 2017
  The Southern University of Science and Technology

## **Research Interest**

My research interest lies in both generative AI and non-equilibrium physics, with an emphasis on physics insights and mathematical solidity. My current research direction includes:

- 1. Generative Diffusion Model: Use physics knowledge to enhance image generation quality and control ability in diffusion models.
- 2. Non-Equilibrium Physics: More accurate Al-based constitutive relations for kinetic theory, rarefied gas dynamics, shock waves, and light scattering.

#### Publications

Generative Diffusion Models

1. **Candi Zheng**<sup>\*†</sup>, Yuan Lan<sup>†</sup>, Yang Wang. "Lanpaint: Training-Free Diffusion Inpainting with Exact and Fast Conditional Inference." Submitted to ICML 2025.

 Candi Zheng<sup>\*†</sup>, Yuan Lan<sup>†</sup>. "Characteristic Guidance: Non-linear Correction for DDPM at Large Guidance Scale." Forty-first International Conference on Machine Learning (ICML). 2024.

Non-equilibrium Statistical Physics

- Florian Kogelbauer<sup>\*†</sup>, Candi Zheng<sup>†</sup>, Ilya Karlin. "Learning the Optimal Hydrodynamic Closure." Submitted to PNAS, 2025.
- Candi Zheng<sup>\*</sup>, Yang Wang, and Shiyi Chen. "Phase Transition in Extended Thermodynamics Triggers Sub-shocks." arXiv:2304.10742 (2023).
- 3. **Candi Zheng**<sup>\*</sup>, Yang Wang , and Shiyi Chen. "Stabilizing the Maximal Entropy Moment Method for Rarefied Gas Dynamics at Single-Precision." arXiv:2303.02898 (2023).
- 4. **Candi Zheng**<sup>\*</sup>, Yang Wang, and Shiyi Chen. "Data-driven constitutive relation reveals scaling law for hydrodynamic transport coefficients." Physical Review E 107, no. 1 (2023): 015104.
- Jin, Yuan-Jun, Rui Wang, Jin-Zhu Zhao, Yong-Ping Du, Can-Di Zheng, Li-Yong Gan, Jun-Feng Liu, Hu Xu<sup>\*</sup>, and S. Y. Tong<sup>\*</sup>. "The prediction of a family group of two-dimensional node-line semimetals." Nanoscale 9, no. 35 (2017): 13112-13118.
- \* for corresponding author <sup>†</sup> for equal contribution

#### Softwares

- 1. Developed the LanPaint: A precise inpaint method capable of deep thinking, requiring no additional training, and compatible with any Stable Diffusion model as well as custom models.
- 2. Developed the Characteristic Guidance Web UI, an extension that enhances the Stable Diffusion web UI (AUTOMATIC1111) with a theory-backed guidance method for high CFG scales.
- 3. Developed the Moment Gauge, a Python JAX library that streamlines implementing momentmethod numerical solvers for gas dynamics.

#### Awards and Scholarships

- o Risk Classification Top 10/2632, ATEC 2018 Developer AI Challenge, Primary round, 2018
- o Outstanding Graduation Project, Southern University of Science and Technology, 2017
- o The University Physics Competition, Silver, 2015
- o RoboMaster, Central South China Division, Third Class, 2015

- o National Encouragement Scholarship, Southern University of Science and Technology, 2014
- o Outstanding Freshman Scholarship, Southern University of Science and Technology, 2014

# Skills

- o Languages: English, Chinese
- O Mathematics: Ph.D.-level analysis and algebra
- O Physics: Statistical physics, kinetic theory
- O Programming: Proficient in Python and OOP; experience with Java, Fortran, CUDA C, MPI
- O Machine Learning: Proficient with PyTorch, JAX, and Scikit-learn