Siwei Luo

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Research Interest

Applied Mathematics, Kinetic Theory, Statistical Physics, PDEs, Probability Theory

Education

University of Science and Technology of China — Hefei, Anhui, China

B.Sc. in Mathematics & Applied Mathematics; ***GPA: 4.04/4.30 (92.42/100)*** — *Sep 2023 – Jun 2027 (expected)*

Relevant coursework[1]**:** Combinatorics (A+, 95/100), Advanced Combinatorics (A+, 95/100), Differential Geometry (H) (A+, 95/100), Advanced Real Analysis (A+, 98/100), Functional Analysis (A+, 98/100), Complex Analysis (H)(En) (A+, 95/100), Modern Algebra (H) (A+, 97/100), Advanced Probability Theory (A+, 97/100), Real Analysis (H) (A, 90/100), Probability Theory (A, 93/100), Topology (H) (A, 93/100), Introduction to Differential Equations (A, 91/100).

Rank: Rank **1st** among all the students majoring in **Applied Mathematics** at USTC.

Honorable Position: I was admitted to **School of the Gifted Young**, USTC in 2023 when I was **15** years old. Then in the sophomore year I was enrolled in the **Hua Loo-Keng Talent Program** in USTC.

Awards & Achievements

2025 S.-T. Yau College Student Mathematics Contest: Honorable Mention in Written Exam. Flagship undergraduate mathematics competition founded by Prof. Shing-Tung Yau (2010) and designed to benchmark against graduate-qualifying exam standards, covering six core areas, visit this website. In 2025, the contest drew 3,500+ individual contestants and I placed **29th** in the Analysis & Differential Equations Exam, receiving Honorable Mention.

2023 Outstanding Freshman Scholarship. Awarded to freshman who are in the top of their class in the comprehensive evaluation.

2024 Chen Linyi Scholarship. Established in 2010 with a donation by Prof. Chen Linyi of USTC, the scholarship recognizes outstanding academic achievement.

2025 Huawei Scholarship. This award recognizes undergraduate excellence.

2024 & 2025 Scholarship for Hua Loo-Keng Talent Program in Mathematics. This scholarship is awarded to top students who are enrolled in the Hua Loo-Keng Talent Program every year.

Publication, Preprint & Manuscript

Preprint: *(in preparation)* **S. Luo.** "On the Discrete-to-Continuous Mass Limit for a Boltzmann Equation with Mass Exchange", 2026.

Academic Report

On the Discrete-to-Continuous Mass Limit for BME — Wuhan, Hubei, China

Wuhan University — *(expected) March 2026*

- Introduce Degond-Liu's research on the Boltzmann Equation with binary mass exchange and the limit from discrete mass to continuous mass, completed by Luo. (cf. Preprints)

Academic Experience

2024 Algebra & Number Theory Summer School — Beijing, China

Academy of Mathematics and Systems Science, Chinese Academy of Sciences — *July 2024 – August 2024*

- Learned Algebraic Geometry, Algebraic Number Theory and Representation Theory of Finite Groups.
- The summer school was established by Prof. Shouwu Zhang (Princeton).

2025 Summer Research in Kinetic Theory — Hong Kong, China

Institute of Mathematical Science, Chinese University of Hong Kong — *July 2025 – August 2025*

[1](H) stands for the honorary course and (En) stands for the course in English language.

- Worked as Honorable Research Assistant (junior) under the supervision of Prof. Renjun Duan (Department of Mathematics, CUHK) and Prof. Zhouping Xin (IMS, CUHK).
- Studied Villani's review on Fisher information in kinetic theory, re-implemented the Fisher–entropy framework on a finite-velocity discrete kinetic model.

On the Discrete-to-Continuous Mass Limit for BME — Hefei, Anhui, China
University of Science and Technology of China — *November 2025 – February 2026*

- Supported by the Undergraduate Research Program under the supervision of Prof. Shunlin Shen.
- We study a spatially homogeneous Boltzmann equation $\partial_t f = Q(f, f)$ while allowing mass exchange between the two particles (BME), conserving total mass, momentum and kinetic energy. We start from the discrete-mass model of Degond–Liu, in which masses live on an elementary grid $m_i = i\varepsilon$ and establish a discrete-to-continuous mass limit. Under boundedness and locally continuous assumptions of collision kernels and finite initial moments and entropy, we construct global nonnegative weak solutions $(F_i^\varepsilon(t, v))_{i\geq 1}$ of the discrete model and obtain a priori estimates uniform in ε.
- By contructing $f^\varepsilon(t, m, v) = \varepsilon^{-1} \sum_{i\geq 1} F_i^\varepsilon(t, v)\chi_{[m_i, m_{i+1})}(m)$, we deduce time-compactness in $C([0, T]; L^1_{\text{loc}}((0, \infty) \times R^d)$–weak). Then we analyze the limit $\varepsilon \to 0$ to show that a subsequence of (f^ε) converges to a weak solution of the continuous equation, without imposing additional velocity compactness assumptions near vanishing mass. The passage to the limit is based on (i) a qualitative consistency result between $\mathcal{Q}^\varepsilon(F^\varepsilon, F^\varepsilon)$ and $\mathcal{Q}(f^\varepsilon, f^\varepsilon)$, and (ii) a bilinear limit argument to identify the quadratic collision term.

Teaching Assistant Experience

Foundation of Algebra — Hefei, Anhui, China
University of Science and Technology of China — *Fall 2025*

Foundation of Geometry — Hefei, Anhui, China
University of Science and Technology of China — *Fall 2025*

Complex Analysis (H)(En) — Hefei, Anhui, China
University of Science and Technology of China — *Spring 2026*

Seminars, Congress & Visits

USTC-FDU Honorable Class Communication — Shanghai, China
Fudan University — *Fall 2024*

Smooth Manifold Seminar — Online
University of Science and Techonology of China — *Winter 2025*

Representation Theory Siminar — Hefei, Anhui, China
University of Science and Technology of China — *Spring 2025*

USTC-XMU Honorable Class Communication — Xiamen, Fujian, China
Xiaman University — *Fall 2025*

2026 ICCM Congress — Shanghai, China
Shanghai Institute for Mathematics and Interdisciplinary Sciences — *Spring 2026*

Workshop on AI for Mathematical Research — Shanghai, China
Feishu Institute — *Spring 2026*

USTC-WHU Honorable Class Communication — Wuhan, Hubei, China
Wuhan University — *(expected) Spring 2026*

Expository papers & Talks

Mathematical Analysis Lecture | *website*

- I was invited to perform a lecture of mathematical analysis, as well as the review methods and suggestions for adjusting the mentality at the end of the semester in USTC.