Taiyang Xu

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Current position

Fudan University, Shanghai, China 07/2024 – now
Department of Mathematics
Postdoctoral Fellow (Mentor: Prof. Lun Zhang)

Education

Fudan University, Shanghai, China 09/2019 – 06/2024
Ph.D. in Mathematics, supervisor Prof. Engui Fan
Thesis title: "*On the long-time asymptotics of the local and nonlocal mKdV equation under the nonzero background*"

China University of Mining and Technology, Xuzhou, China 09/2015 – 06/2019
B.Sc. in Mathematics, Distinguished Honor
Thesis title "*Inverse scattering theory and integrability on several kinds of nonlinear evolution equations*"

Research interests

Integrable PDEs, Random matrices theory, Determinantal point processes, Orthogonal polynomials, Asymptotic analysis, Riemann-Hilbert (RH) problems, Special functions, Painlevé equations.

Research articles

Preprints

1. Confluent hypergeometric kernel determinant on multiple large intervals (with Lun Zhang and Zhengyang Zhao)
   Submitted.

Publications in refereed journals

1. Painlevé transcendents in the defocusing mKdV equation with non-zero boundary conditions (with Engui Fan and Zhaoyu Wang)
   Communications in Mathematical Physics, 406 (2025), 181.
2. Soliton resolution and asymptotic stability of N-soliton solutions for the defocusing mKdV equation with finite density type initial data (with Engui Fan and Zechuan Zhang)
   Physica D: Nonlinear Phenomena, 472 (2025), 134526.
3. Transient asymptotics of the modified Camassa-Holm equation (with Yiling Yang and Lun Zhang)
   Journal of the London Mathematical Society, 110 (2024), e12967.
4. On the Cauchy problem of defocusing mKdV equation with finite density initial data: long-time asymptotics in soliton-less regions (with Engui Fan and Zechuan Zhang)
   Journal of Differential Equations, 372 (2023), 55–122.
5. Large-time asymptotics to the focusing nonlocal modified Kortweg-de Vries equation with step-like boundary conditions (with Engui Fan)
   Studies in Applied Mathematics, 150 (2023), 1217–1273.
6. Riemann-Hilbert approach for multisoliton solutions of generalized coupled fourth-order nonlinear Schrödinger equations (with Weiqi Peng and Shoufu Tian)
   Mathematical Methods in the Applied Sciences, 43 (2020), 865–880.

Grants

– Shanghai Post-doctoral Excellence Program 2024 – 2026
Grant No. 2024100
"*Riemann-Hilbert Method for Several Asymptotic Problems related to Universality from Integrable Systems and Random Matrix Theory*"
Role: Principal Investigator

– China Postdoctoral Science Foundation 2024 – 2026
Grant No. 2024M760480
"*Semiclassical Asymptotics and Universality for Nonlinear Integrable Shallow Water Wave Systems*"
Role: Principal Investigator

Teaching activities

2019 – 2026 @Fudan
- Spring, 2024: TA of Methods of Asymptotic Analysis (MATH630117).
- Fall, 2021: TA of Calculus A (MATH120021.02).
- Spring, 2020: TA of Calculus B (MATH120004.01) (Online).
- Fall, 2019: TA of Calculus B (MATH120003.01).

Scholarships and awards

2019 – 2024 @Fudan (Doctorate)
- Graduation with Honors (Shanghai Outstanding Graduate), 2024.
- Scholarship provided by Huatai Securities Technology, 2023.
- Scholarship provided by Pacific Insurance Company, 2022.
- Outstanding Doctoral Candidate Scholarship provided by Fudan University, 2021.
- Doctoral Scholarship of the Year provided by Fudan University, 2019–2023.

2015 – 2019 @CUMT (Undergraduate)
- Outstanding Undergraduates in China University of Mining and Technology, 2019.

Co-organized activities

- (with Lun Zhang) Mini-workshop on Asymptotic Analysis, Fudan University, Shanghai, China, 5th–6th & 9th June, 2025.

Attended activities

- Universality, Nonlinearity, and Integrability, In honor of Percy Deift, Seoul, Korea, 12–16 May, 2025.
- The 2nd Workshop on Integrable Systems and Random Matrix Theory, Dongguan, China, 5–17 Jan, 2025.
  (Invited talk: "*Transient asymptotics of the modified Camassa-Holm equation*")
- Random Matrix Summer School, University of Michigan, Ann Arbor, USA, 17–28 June, 2024.
- Random Matrices and Related Topics, Jeju island, Korea, 6–10 May, 2024.
- The 15th Hemudu Forum on Integrable Systems, Ningbo, China, 24–26 Nov, 2023.
  (Contributed talk: "*Integrable PDEs with nonzero boundary conditions: large-time asymptotics*")
- Foundations of Computational Mathematics 2023 (FoCM2023), Paris, France, 12–21 June, 2023.
- The 13rd Hemudu Forum on Integrable Systems, Ningbo, China, 15–17 Oct, 2021.

Academic visits

- 31/03/2025 – 11/04/2025, Chongqing University, China. (Host: Yiling Yang)

(I greatly appreciate for their warm hospitality)

Other presentations

Outreach talks

- "*Some asymptotic problems in mathematical physics*", Shanghai Institute of Technical Physics, Shanghai, China, 29th April, 2025.

2019 – 2026 @Fudan Integrable Systems and Random Matrix Theory Seminar

- "*Fredholm determinants from Schrödinger type equations, and deformation of Tracy-Widom distribution*" (reading report), Oct, 2024.
- "*Biorthogonal measures, polymer partition functions, and random matrices*" (reading report), April, 2024.
- "*Painlevé type asymptotics for the Camassa-Holm equation*" (reading report), Oct, 2022.
- "*A Riemann-Hilbert approach to Fredholm determinants of Hankel composition operators: scalar-valued kernels*" (reading report), Sept – Oct, 2022.
- "*Primitive potentials and bounded solutions of the KdV equation*" (reading report), Sept. 2022.
- "*Soliton V. The gas: Fredholm determinants, analysis and the rapid oscillations behind the kinetic equation*" (reading report), May – June, 2022.
- "*Airy kernel determinant solutions to the KdV equation and integro-differential Painlevé equations*" (reading report), Mar, 2022.
- "*The defocusing nonlinear Schrödinger equation with step-like oscillatory initial data*" (reading report), Oct, 2022.
- "*Momenta spacing distributions in anharmonic and the higher order finite temperature Airy kernel*" (reading report), Oct, 2022.
- "*Long-Time behavior of the non-focusing nonlinear Schrödinger equation – a case study*" (reading report), April, 2022.
- "*On the origins of Riemann-Hilbert problems in mathematics* " (reading report), Mar, 2022.

Status

China – citizen

Languages

- Chinese (native)
- English

Computer skills

LaTeX, Mathematica, Matlab, HTML, C++, Javascript

Tuesday 12th August, 2025