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. *Painlevé transcendents in the defocusing mKdV equation with non-zero boundary conditions* (with Zhaoyu Wang and Engui Fan)
   (arXiv:2306.07073)

Publications in refereed journals

1. *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.
   (DOI: 10.1016/j.physd.2025.134526) (arXiv: 2108.03650)
2. *Transient asymptotics of the modified Camassa-Holm equation* (with Yiling Yang and Lun Zhang)
   Journal of the London Mathematical Society, 110 (2024), e12967.
   (DOI: 10.1112/jlms.12967) (arXiv: 2308.06950)
3. *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.
   (DOI: 10.1016/j.jde.2023.06.038) (arXiv: 2108.06284)
4. *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.
   (DOI: 10.1111/sapm.12568) (arXiv: 2208.01268)
5. *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.
   (DOI: 10.1002/mma.5964)

Grants

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

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

Teaching Activities

@ Fudan (2019 – 2026)
– 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 & Awards

2019 – 2024 (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 (Undergraduate)
– Outstanding Undergraduates in China University of Mining and Technology, 2019.

Seminars

@ Fudan Integrable Systems and Random Matrix Theory Seminar (2019 – 2026)
– "*Fredholm determinants from Schrödinger type equations, and deformation of Tracy-Widom distribution*", Oct, 2024.
– "*Biorthogonal measures, polymer partition functions, and random matrices*", April, 2024.
– "*Painlevé type asymptotics for the Camassa-Holm equation*", Oct, 2022.
– "*A Riemann-Hilbert approach to Fredholm determinants of Hankel composition operators: scalar-valued kernels*", Sept - Oct, 2022.
– "*Primitive potentials and bounded solutions of the KdV equation*", Sept. 2022.
– "*Soliton V. The gas: Fredholm determinants, analysis and the rapid oscillations behind the kinetic equation*", May - June, 2022.
– "*Airy kernel determinant solutions to the KdV equation and integro-differential Painlevé equations*", Mar, 2022.
– "*The defocusing nonlinear Schrödinger equation with step-like oscillatory initial data*", Oct, 2022.
– "*Momenta spacing distributions in anharmonic and the higher order finite temperature Airy kernel*", Oct, 2022.
– "*Long-Time behavior of the non-focusing nonlinear Schrödinger equation – a case study*", April, 2022.
– "*On the origins of Riemann-Hilbert problems in mathematics* ", Mar, 2022.

Conferences

– The 2nd Workshop on Integrable Systems and Random Matrix Theory, Dongguan, China, 5-17 Jan, 2025. (Talk: "*Transient asymptotics of the modified Camassa-Holm equation*")
– 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. (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.

Summer School – Random Matrix Summer School, University of Michigan, Ann Arbor, USA, 17-28 June, 2024.

Status **China** – citizen

Languages
- Chinese (native)
- English (fluent)

Computer Skills LaTeX, Mathematica, Matlab, HTML, C++, JavaScript