

# Taiyang Xu

## Fudan University

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<b>Current position</b>	<b>Fudan University</b> , Shanghai, China Department of Mathematics Postdoctoral Fellow (Mentor: Prof. Lun Zhang)	07/2024 – now
<b>Education</b>	<b>Fudan University</b> , Shanghai, China Ph.D. in Mathematics, supervisor Prof. Engui Fan Thesis title: “ <i>On the long-time asymptotics of the local and nonlocal mKdV equation under the nonzero background</i> ”  <b>China University of Mining and Technology</b> , Xuzhou, China B.Sc. in Mathematics, Distinguished Honor Thesis title: “ <i>Inverse scattering theory and integrability on several kinds of nonlinear evolution equations</i> ”	09/2019 – 06/2024  09/2015 – 06/2019
<b>Research interests</b>	Integrable PDEs, Random matrices theory, Determinantal point processes, Orthogonal polynomials, Asymptotic analysis, Riemann-Hilbert (RH) problems, Special functions, Painlevé equations.	
<b>Publications</b>	<b>Preprints</b> <ol style="list-style-type: none"><li>Confluent hypergeometric kernel determinant on multiple large intervals (with Lun Zhang and Zhengyang Zhao) <i>arXiv:2508.10463</i></li><li>On the large-time asymptotics of the defocusing mKdV equation with step-like initial data <i>arXiv:2204.01299</i></li></ol> <b>Publications in refereed journals</b> <ol style="list-style-type: none"><li>Painlevé transcendents in the defocusing mKdV equation with non-zero boundary conditions (with Engui Fan and Zhaoyu Wang) <i>Communications in Mathematical Physics</i>, 406 (2025), 181.</li><li>Soliton resolution and asymptotic stability of <math>N</math>-soliton solutions for the defocusing mKdV equation with finite density type initial data (with Engui Fan and Zechuan Zhang) <i>Physica D: Nonlinear Phenomena</i>, 472 (2025), 134526.</li><li>Transient asymptotics of the modified Camassa-Holm equation (with Yiling Yang and Lun Zhang) <i>Journal of the London Mathematical Society</i>, 110 (2024), e12967.</li><li>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) <i>Journal of Differential Equations</i>, 372 (2023), 55–122.</li><li>Large-time asymptotics to the focusing nonlocal modified Kortweg-de Vries equation with step-like boundary conditions (with Engui Fan) <i>Studies in Applied Mathematics</i>, 150 (2023), 1217–1273.</li><li>Riemann-Hilbert approach for multisoliton solutions of generalized coupled fourth-order nonlinear Schrödinger equations (with Weiqi Peng and Shoufu Tian) <i>Mathematical Methods in the Applied Sciences</i>, 43 (2020), 865–880.</li></ol>	
<b>Grants</b>	– Shanghai Post-doctoral Excellence Program (Grant No. 2024100) Project: Riemann-Hilbert method for several asymptotic problems related to universality from integrable systems and random matrix theory Role: Principal Investigator	

- China Postdoctoral Science Foundation (Grant No. 2024M760480) 07/2024 – 07/2026  
Project: Semiclassical asymptotics and universality for nonlinear integrable shallow water wave systems  
Role: Principal Investigator

**Teaching activities 09/2019 – 07/2026 @Fudan**

- Fall, 2025: Recitation & Tutorial Instructor of Advanced Calculus III (MATH130001.04).
- 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 09/2019 – 06/2024 @Fudan (Doctorate)**

- Shanghai Outstanding Graduate (Graduation with Honors), 2024.
- Huatai Securities Science and Technology Scholarship, 2023.
- Pacific Insurance Company Scholarship, 2022.
- Outstanding Doctoral Candidate Scholarship, Fudan University, 2021.
- Fudan University Doctoral Scholarship, 2019–2023.

**09/2015 – 06/2019 @CUMT (Undergraduate)**

- Outstanding Undergraduates in China University of Mining and Technology, 2019.

**Co-organized activities**

- (with Lun Zhang) Weekly RMT seminar @Fudan, 09/2022 – now.
- (with Lun Zhang) Mini-workshop on Asymptotic Analysis, Fudan University, Shanghai, China, 5–9 Jun, 2025.

**Attended activities (with some talks)**

- 5th ZiF Summer School “Randomness in Physics and Mathematics: From Thermalisation in Quantum Systems to Random Matrices”, Universität Bielefeld, Bielefeld, Germany, 25 Aug–6 Sep, 2025.  
⇒ Contributed talk: “*Confluent hypergeometric kernel determinant on multiple large intervals*”
- Seminar @UCLouvain, Louvain-la-Neuve, Belgium, 21 Aug, 2025.  
⇒ Invited talk: “*An introduction to Dubrovin’s universality conjecture for integrable PDEs, and some progress on the Camassa-Holm equation*”
- 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 Jun, 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 Jun, 2023.
- The 13rd Hemudu Forum on Integrable Systems, Ningbo, China, 15–17 Oct, 2021.

- Academic visits**
- 18/08/2025 – 24/08/2025, UCLouvain, Belgium. (Host: Christophe Charlier)
  - 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 Apr, 2025.

**09/2019 – 07/2026 @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), Apr, 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 – Jun, 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), Apr, 2022.
- “*On the origins of Riemann-Hilbert problems in mathematics*” (reading report), Mar, 2022.

**Status** **China** – citizen, **Married**.

**Languages**

- Chinese (native), The Qianwei dialect of Sichuanese (native)
- English

**Computer skills**  $\LaTeX$ , Mathematica, Matlab, HTML, C++, Javascript

Wednesday 8<sup>th</sup> October, 2025