

## Taiyang XU / 徐太阳

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### Employment

**Fudan University / 复旦大学**

Shanghai, China

*Postdoctoral Researcher* in the Department of Mathematics

2024 - Present

Mentor: Lun Zhang

### Education

**Fudan University / 复旦大学**

Shanghai, China

*Ph.D. in Mathematics*

2019 - 2024

Thesis: *On the long-time asymptotics of the local and nonlocal mKdV equation under the nonzero background /*

非零背景下局域和非局域 *mKdV* 方程-解的长时间渐近分析

Mentor: Engui Fan

**China University of Mining and Technology / 中国矿业大学**

Xuzhou, Jiangsu Province, China

*B.Sc. in Mathematics, Distinguished Honor*

2015 - 2019

Thesis: *Inverse scattering theory and integrability on several kinds of nonlinear evolution equations / 几类非线性发展方程的反散射方法及其可积性质的研究*

Thesis advisor: Shoufu Tian

### 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)  
**To appear in Physica D.**  
(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)

### Fellowships and Grants

- Shanghai Post-doctoral Excellence Program, 2024–2026. / 上海市超级博士后项目.  
“*Riemann-Hilbert Method for Several Asymptotic Problems related to Universality from Integrable Systems and Random Matrix Theory*” / “可积系统和随机矩阵理论中若干渐近问题的普适性探索：黎曼-希尔伯特方法”  
Role: Host / 主持
- China Postdoctoral Science Foundation (Certificate No. 2024M760480), 2024-2026. / 中国博士后科学基金第 76 批面上资助.  
“*Semiclassical Asymptotics and Universality for Nonlinear Integrable Shallow Water Wave Systems*” / “非线性可积浅水波系统的半经典渐近与普适性”  
Role: Host / 主持

## Teaching Activities

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

## Scholarships and Awards

### Doctorate

- Graduation with Honors (Shanghai Outstanding Graduate), 2024. / 上海市优秀毕业生 (研究生).
- Scholarship provided by Huatai Securities Technology, 2023. / 华泰证券科技奖学金.
- Scholarship provided by Pacific Insurance Company, 2022. / 太平洋保险奖学金.
- Outstanding Doctoral Candidate Scholarship provided by Fudan University, 2021. / 优秀博士候选人奖学金.
- Doctoral Scholarship of the Year provided by Fudan University, 2019-2023. / 博士生学年学业奖学金.

### Undergraduate

- Outstanding Undergraduates in China University of Mining and Technology, 2015-2019. / 中国矿业大学优秀毕业生.

## Seminars

### Seminars on Random Matrix Theory and Integrable Systems in Fudan during 2019–2026

(Here I only list the talks given by myself.)

- *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*, Dec, 2021 and Mar, 2022.
- *The defocusing nonlinear Schrödinger equation with step-like oscillatory initial data*, Oct, 2021.
- *Momenta spacing distributions in anharmonic and the higher order finite temperature Airy kernel*, Oct, 2021.
- *Long-Time behavior of the non-focusing nonlinear Schrödinger equation – a case study*, April, 2021.
- *On the origins of Riemann-Hilbert problems in mathematics*, Nov, 2020 and Mar, 2021.

### Conferences & Workshops

(\* indicates that I gave a talk.)

- \*The 2nd Workshop on Integrable Systems and Random Matrix Theory 2025, Dongguan, China, 5-17 Jan, 2025.
- 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.
- 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.