

CURRICULUM VITA

Chen-Chih Lai

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APPOINTMENTS

Assistant Professor, Department of Mathematical Sciences, Middle Tennessee State University, Murfreesboro, TN, United States Aug 2026 – present

Postdoctoral Scholar, Department of Mathematics, Michigan State University, East Lansing, MI, United States Jun 2026 – Jul 2026
Mentor: Guowei Wei

Postdoctoral Research Scientist, Department of Mathematics, Columbia University, New York, NY, United States Aug 2021 – Jul 2024
Mentor: Michael I. Weinstein

EDUCATION AND TRAINING

The University of British Columbia, Vancouver, BC, Canada Sep 2017 – Jul 2021
Ph.D. in Mathematics
Thesis: *Study and analysis of some incompressible fluid PDEs: the Navier–Stokes equations in the half space, the MHD and the viscoelastic Navier–Stokes equations, and coupled Keller–Segel–fluid models*
Advisors: Tai-Peng Tsai and Juncheng Wei

National Center for Theoretical Sciences, Mathematics Division, Taipei, Taiwan Aug 2016 – Jul 2017
Research Assistant
Advisor: Chun-Hsiung Hsia

National Taiwan University, Taipei, Taiwan Sep 2014 – Jun 2016
M.Sc. in Mathematics
Thesis: *On the N -barrier maximum principle for traveling wave solutions of diffusive competitive Lotka–Volterra systems*
Advisor: Chun-Hsiung Hsia

National Taiwan University, Taipei, Taiwan Sep 2010 – Jun 2014
B.Sc. in Mathematics

RESEARCH INTERESTS

nonlinear partial differential equations, Navier–Stokes equations, Green tensor of Stokes system, bubble dynamics, free boundary problems, coupled fluid systems, data-driven learning of governing laws in stochastic dynamics using variational approaches in generalized diffusions, concentration and blow-up phenomena for parabolic PDEs, reaction–diffusion systems

PUBLICATIONS

1. **Global well-posedness of the 2D stochastic self-consistent Keller-Segel-Navier-Stokes system with subcritical cellular mass.** (with Fanze Kong and Krutika Tawri) *arXiv:2605.17114* (2026).
2. **Nonspherically symmetric equilibrium bubbles in a steadily rotating incompressible fluid.** (with Michael I. Weinstein) *Nonlinearity* 39.3 (2026): 035012.
3. **Weak and mild solutions to the MHD equations and the viscoelastic Navier-Stokes equations with damping in Wiener amalgam spaces.** *J. Differential Equations* 452 (2026): 113777.
4. **Joint inviscid, incompressible, and continuous phenotype limit in nonlocal models of tissue growth.** (with Hongbo Lu) *arXiv:2509.16416* (2025).
5. **Moment estimates and DeepRitz methods on learning diffusion systems with non-gradient drifts.** (with Fanze Kong and Yubin Lu) *arXiv:2509.10495* (2025). Machine Learning and the Physical Sciences Workshop at NeurIPS 2025.
6. **Moment estimate and variational approach for learning generalized diffusion with non-gradient structures.** (with Fanze Kong and Yubin Lu) *arXiv:2508.01854* (2025).
7. **Asymmetric deformations of a perturbed spherical bubble in an incompressible fluid.** (with Michael I. Weinstein) *SIAM J. Appl. Math.* 85.3 (2025): 1212–1236.
8. **Applications of the Green tensor estimates of the nonstationary Stokes system in the half space.** (with Kyungkeun Kang, Baishun Lai, and Tai-Peng Tsai) *SIAM J. Math. Anal.* 57.1 (2025): 1137–1194.
9. **Global existence and aggregation of chemotaxis-fluid systems in dimension two.** (with Fanze Kong, and Juncheng Wei) *J. Differential Equations* 400 (2024): 1–89.
10. **Mild solutions and spacetime integral bounds for Stokes and Navier-Stokes flows in Wiener amalgam spaces.** (with Zachary Bradshaw, and Tai-Peng Tsai) *Math. Ann.* 388.3 (2024): 3053–3126.
11. **Thermal relaxation toward equilibrium and periodically pulsating spherical bubbles in an incompressible liquid.** (with Michael I. Weinstein) *Nonlinear Anal.* 238 (2024): 113397.
12. **Free boundary problem for a gas bubble in a liquid, and exponential stability of the manifold of spherically symmetric equilibria.** (with Michael I. Weinstein) *Arch. Ration. Mech. Anal.* 247.5 (2023): 100.
13. **The Green tensor of the nonstationary Stokes system in the half space.** (with Kyungkeun Kang, Baishun Lai, and Tai-Peng Tsai) *Comm. Math. Phys.* 399.2 (2023): 1291–1372. **Correction: The Green tensor of the nonstationary Stokes system in the half space.** *Comm. Math. Phys.* 406.12 (2025): 318.
14. **Global existence of free-energy solutions to the 2D Patlak–Keller–Segel–Navier–Stokes system with critical and subcritical mass.** (with Juncheng Wei, and Yifu Zhou) *Indiana Univ. Math. J.* 72.1 (2023): 43–87.
15. **Finite energy Navier–Stokes flows with unbounded gradients induced by localized flux in the half-space.** (with Kyungkeun Kang, Baishun Lai, and Tai-Peng Tsai) *Trans. Amer. Math. Soc.* 375.09 (2022): 6701–6746.
16. **Finite time blow-up for the nematic liquid crystal flow in dimension two.** (with Fanghua Lin, Changyou Wang, Juncheng Wei, and Yifu Zhou) *Comm. Pure Appl. Math.* 75.1 (2022): 128–196.
17. **New type II finite time blow-up for the energy supercritical heat equation.** (with Manuel del Pino, Monica Musso, Juncheng Wei, and Yifu Zhou) *arXiv:2006.00716* (2020).

18. **Forward discretely self-similar solutions of the MHD equations and the viscoelastic Navier–Stokes equations with damping.** *J. Math. Fluid Mech.* 21.3 (2019): 38.
19. **An N-barrier maximum principle for autonomous systems of n species and its application to problems arising from population dynamics.** (with Chiun-Chuan Chen, and Li-Chang Hung) *Commun. Pure Appl. Anal.* 18.1 (2019): 33–50.

WORK IN PROGRESS

20. **Discretely self-similar solutions to coupled fluid systems with large data in L^2_{loc}** (with Tai-Peng Tsai)
21. **Moment-DeepRitz method for learning non-gradient drifts in diffusions from trajectory data** (with Fanze Kong and Yubin Lu)
22. **Thermal effects on the linear stability of gas bubble shape deformation in a liquid** (with Michael I. Weinstein)
23. **Pressure tensor estimate and local energy solutions of the Navier-Stokes equations in the half space** (with Tai-Peng Tsai)
24. **The 2D incompressible Euler equations with degenerate viscosity coefficients on bounded domains: well-posedness, inviscid limit, enstrophy dissipation, and sharpness of the double-exponential bound** (with Min Jun Jo)
25. **Spatial decay of mild solutions of self-consistent chemotaxis–fluid systems in the half space** (with Fanze Kong)

AWARDS

AMS-Simons Travel Grant, The American Mathematical Society and Simons Foundation (mentor: Michael I. Weinstein), \$ 3,000 USD/year	2023 – 2025
President’s Academic Excellence Initiative PhD Award, UBC, \$ 1,166.92 CAD	2020 – 2021
Stanley M Grant Scholarship in Mathematics, UBC, \$ 500 CAD	2018
International Tuition Award, UBC, \$ 8,533.32 CAD	2017 – 2021
Four Year Fellowship for PhD Students (FYF), UBC, \$ 48,533.32 CAD	2017 – 2021
Four Year Doctoral Fellowship (4YF), UBC, \$ 14,878.21 CAD	2017 – 2021
TMS Outstanding Thesis Award, The Mathematical Society of the Republic of China	2016
Dean’s Award, College of Science, NTU	2016

ACADEMIC SERVICES

Reviewer: Mathematical Reviews (MR)

Referee: Calc. Var. Partial Differential Equations, J. Phys. A, Z. Angew. Math. Phys., J. Math. Fluid Mech., Taiwanese J. Math., Bull. Malays. Math. Sci. Soc., Commun. Anal. Mech.

Seminar organized:

- Waves Working Group (with Joe Kraisler), Columbia U Sep 2022 – May 2023
(with Xuenan Li), Columbia U Sep 2023 – Dec 2023

Conference organized:

- Free Boundary Problems: Lecture Series and Recent Advances in Theory and Applications (with Daniela De Silva, Qiang Du, Kui Ren, Ovidiu Savin, James M. Scott, and Michael I. Weinstein), Columbia U May 30 – Jun 2, 2023

High School Lecture Series organized:

- Mathematics Lecture Series on Everyday Life and Technology, Ministry of Science and Technology, Taiwan
Aug 2015 – Jul 2016
served as an *Administrative Assistant* supervised by Chun-Hsiung Hsia

CONFERENCE/WORKSHOP PRESENTATIONS

- Poster presenter, *Machine Learning and the Physical Sciences Workshop (ML4PS)*, The Thirty-Ninth Annual Conference on Neural Information Processing Systems (NeurIPS 2025), San Diego, CA, United States
Dec 6 – 7, 2025
- Invited speaker, *Recent Development on Free Surface Flows*, The Thirteenth International Conference on Nonlinear Evolution Equations and Wave Phenomena: Computation and Theory, The Classic Center, Athens, GA, United States
April 14, 2025
- Invited speaker, *Nonlinear Partial Differential Equations and Applications*, In honor of Bob Pego, Carnegie Mellon University, Pittsburgh, PA, United States
May 4, 2024
- Invited speaker, *Special Session on Recent Developments in the Study of Free Boundary Problems in Fluid Mechanics*, AMS Spring Eastern Sectional Meeting, Howard University, Washington, DC, United States
April 7, 2024
- Invited speaker, *AMS Special Session on Dynamics and Regularity of PDEs*, Joint Mathematics Meetings, San Francisco, CA, United States
Jan 5, 2024
- Contributed talk speaker, *RTG Workshop on Physics- and Data-Driven Applied Mathematics*, Columbia University, New York, NY, United States
Dec 18, 2023
- Contributed talk speaker, *Special Session on Dynamics of Partial Differential Equations*, AMS Spring Southeastern Sectional Meeting, Georgia Institute of Technology, Atlanta, GA, United States
Mar 18, 2023
- Invited speaker, *Special Session on Recent Advances in the Theory of Fluid Dynamics*, AMS Fall Western Sectional Meeting, University of Utah, Salt Lake City, UT, United States
Oct 22, 2022
- Invited speaker, *Special Session on Elliptic and Parabolic PDEs in Complex Fluid and Free Boundary Problems*, AMS Fall Central Sectional Meeting, University of Texas at El Paso, El Paso, TX, United States
Sep 17, 2022
- Contributed talk speaker, *AMS Contributed Paper Session on Partial Differential Equations*, Joint Mathematics Meetings, online
Apr 6, 2022
- Poster presenter, *Conference on Nonlinear Partial Differential Equations and Application*, Michigan Center for Applied and Interdisciplinary Mathematics, Ann Arbor, MI, United States
Jul 9 – 12, 2019
- Invited speaker, *The 7th Taiwan-Japan Joint Workshop for Young Scholars in Applied Mathematics*, National Cheng Kung University, Tainan, Taiwan
Feb 28, 2016

SEMINAR/COLLOQUIUM PRESENTATIONS

- *Research Talk*, Georgia Southern University, Statesboro, GA, United States
Feb 12, 2026
- *Research Talk*, Old Dominion University, Norfolk, VA, United States
Feb 10, 2026
- *Mathematical Sciences Colloquium*, The University of Texas at Dallas, Richardson, TX, United States
Feb 5, 2026
- *Colloquium Talk*, Middle Tennessee State University, Murfreesboro, TN, United States
Feb 3, 2026
- *Faculty Interview Talk*, University of Oklahoma, Norman, OK, United States
Jan 29, 2026
- *Applied Math Colloquium*, Rochester Institute of Technology, Rochester, NY, United States
Feb 12, 2025

- *Mathematical Sciences Department Colloquium*, Worcester Polytechnic Institute, Worcester, MA, United States Jan 22, 2025
- *Recruitment Seminar*, Ohio State University, Columbus, OH, United States Jan 7, 2025
- *Applied and Computational Mathematics Seminar*, Rutgers University, online Oct 18, 2024
- *DG MP PDE Seminar*, The University of British Columbia, online Oct 10, 2024
- *Academic Lecture on Frontier Intelligent Complex Systems*, Fudan University, online Jul 3, 2024
- *Math Department Colloquium*, University of Florida, Gainesville, FL, United States Jan 26, 2024
- *Analysis Seminar*, University of Arkansas, Fayetteville, AR, United States Dec 7, 2023
- *Columbia Analysis Seminar*, Columbia University, New York, NY, United States Sep 29, 2023
- *Michael Zhao Memorial Student Colloquium*, Columbia University, New York, NY, United States Mar 7, 2023
- *Drexel PDE/Applied Math Seminar*, Drexel University, Philadelphia, PA, United States Feb 10, 2023
- *Waves Working Group*, Columbia University, New York, NY, United States Oct 12 & Oct 26 & Nov 16, 2022
- *NCTS Nonlinear PDE and Analysis Seminar*, National Center for Theoretical Sciences, Taipei, Taiwan Aug 11, 2022
- *Analysis & PDE Seminar*, Johns Hopkins University, online Nov 15, 2021
- *Waves Working Group*, Columbia University, online Oct 27 & Nov 3, 2021
- *Geometry & Analysis Seminar*, Columbia University, New York, NY, United States Sep 17, 2021
- *Differential Equations Seminar*, University of Michigan, online Feb 18, 2021
- Invited speaker at *Nonlinear Phenomena in Evolutionary Partial Differential Equations*, National Taiwan University, Taipei, Taiwan Dec 31, 2019 – Jan 8, 2020
- *Student Colloquium*, National Taiwan University, Taipei, Taiwan Apr 15, 2016
- *NCTS PDE & Analysis Seminar*, National Taiwan University, Taipei, Taiwan Nov 5, 2015

SHORT TERM VISITS

- Princeton University, Princeton, NJ, United States Apr 11, 2024
- Institute for Advanced Study, Princeton, NJ, United States Nov 6, 2023
- National Taiwan University, Taipei, Taiwan Jul 27 – Aug 12, 2022
- The University of British Columbia, Vancouver, Canada Dec 14 – 20, 2022

STUDENTS SUPERVISED

Master's Students mentored:

- Hongbo Lu (with Michael I. Weinstein), Columbia U Nov 2022 – Jul 2024
Inviscid limit for a porous medium type tumor growth model

Undergraduate Students mentored:

- Ruitong Liu, Columbia U (Barnard Summer Institute Program) May – Aug 2023
A numerical study of thermal dissipation rate in spherical bubble dynamics: Root finding

High School Students mentored:

- Amit Saha, Great Neck South High School 2022
The WAC Lighting Invitational Science Fair, **2nd place** in Computer Science
Developing a Physics-Informed Fourier neural operator for magnetohydrodynamics

TEACHING EXPERIENCE

Instructor , <i>Elements of Linear Algebra</i> (MATH 2010) at MTSU	Fall, 2026
Instructor , <i>Differential Equations I</i> (MATH 3120) at MTSU	Fall, 2026
Instructor , <i>Linear Algebra and Probability</i> (MATH UN2015) at Columbia U	Spring, 2024
Instructor , <i>Calculus III</i> (MATH UN1201) at Columbia U	Spring, 2023
Instructor , <i>Analysis and Optimization</i> (MATH UN2500) at Columbia U	Fall, 2022
Instructor , <i>Calculus III</i> (MATH UN1201) at Columbia U	Spring, 2022
Instructor , <i>Calculus III</i> (MATH UN1201) at Columbia U	Fall, 2021
Instructor , <i>Differential Calculus</i> (MATH 110) at UBC	Winter 2, 2019
Recitation Instructor , <i>Differential Calculus</i> (MATH 180) at UBC	Winter 1, 2019
Workshop Leader, <i>Differential Calculus</i> (MATH 184) at UBC	Winter 1, 2018
Computer Labs TA, <i>Linear Systems</i> (MATH 152) at UBC	Winter 2, 2017
Recitation Instructor , <i>Calculus (general Mathematics) (b)</i> at NTU	Fall 2014 – Spring 2015
Recitation Instructor , <i>Functions of a Complex Variable</i> at NTU	Fall 2014