Fan Yang

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EDUCATION AND TRAINING

Post-doctoral Scholar in Biology and Biological Engineering, 2021 - Present
California Institute of Technology Pasadena, CA
Supervisor: Prof. Matt Thomson

PhD in Department of Mechanical and Aerospace Engineering, 2015 - 2021
Princeton University Princeton, NJ
Supervisor: Prof. Howard A. Stone
Thesis: Interfacial Flows in Active Matter and Energy Processes

Bachelor of Engineering in Mechanical Engineering, 2011 - 2015
Tsinghua University Beijing, China
GPA: 92.2/100 Ranking: 1st/84
Thesis: Numerical Simulations of Continuous Casting with Electromagnetic Stirring

PUBLICATIONS

1. **F. Yang**, S. Liu, H. J. Lee, R. Phillips and M. Thomson. Dynamic Flow Control Through Active Matter Programming Language. ***Nature Materials***, 24, 615-625, 2025.
   ★ ***Nature Materials*** News & Views: "Illuminating active matter by harnessing light for modular flow control".
   ★ ***Nature Chemical Engineering*** Research Highlight: "Programming fluid flow with biological active matter".

2. **F. Yang**, S. Liu, H. J. Lee, R. Phillips and M. Thomson. Active Healing of Microtubule-Motor Networks. Under review at *Physical Review Letters*. Also available at arXiv:2407.00842.

3. S. Liu, R. W. Pan, H. J. Lee, S. Shadkhoo, **F. Yang**, C. Li, Z. Qu, R. Phillips and M. Thomson. Force Propagation in Active Cytoskeletal Networks. arXiv:2401.04217. 2024

4. Z. Qu, D. Schildknecht, S. Shadkhoo, E. Amaya, J. Jiang, H. J. Lee, D. Larios, **F. Yang**, R. Phillips and M. Thomson. Persistent fluid flows defined by active matter boundaries. ***Communications Physics***, 4, 198, 2021.

5. **F. Yang**, A. A. Pahlavan, S. Mendez, M. Abkarian and H. A. Stone. Towards improved social distancing guidelines: space and time dependence of virus transmission from speech-driven aerosol transport between two individuals. ***Physical Review Fluids (Rapid Communication)***, 5, 122501, 2020.
   ★ Selected as *Editors' Suggestion.*

6. A. Khodak, **F. Yang**, and H. A. Stone. Free-Surface Liquid Lithium Flow Modeling and Stability Analysis for Fusion Applications. ***Journal of Fusion Energy***, 39, 455-461, 2020.

7. M. Abkarian, S. Mendez, N. Xue, **F. Yang**, and H. A. Stone. Speech Can Produce Jet-like Transport Relevant to Asymptomatic Spreading of Virus. ***Proceedings of the National Academy of Sciences of the United States of America***, 202012156, 2020.

8. **F. Yang**, H. A. Stone, Formation, rupture, and healing of an annular viscous film, ***Physical Review Letters***, 124, 224501, 2020.

9. T. S. Chan, **F. Yang**, A. Carlson, Directional spreading of a viscous droplet on a conical fibre, ***Journal of Fluid Mechanics***, 894, A26, 2020.
10. B. Rallabandi, **F. Yang**, H. A. Stone, Motion of hydrodynamically interacting active particles, arXiv:1901.04311.
11. **F. Yang**, B. Rallabandi, H. A. Stone, Autophoresis of two adsorbing/desorbing particles in an electrolyte solution, ***Journal of Fluid Mechanics***, 865, 440-459, 2019.
12. **F. Yang**, A. Khodak, H. A. Stone, The effects of a horizontal magnetic field on the Rayleigh-Taylor instability, ***Nuclear Materials and Energy***, 18, 175-181, 2019.
13. **F. Yang**, S. Shin, H. A. Stone, Diffusiophoresis of a charged drop, ***Journal of Fluid Mechanics***, 852, 37-59, 2018.

RESEARCH EXPERIENCE

California Institute of Technology 2021 - Present
Post-doctoral Scholar, Biology & Biological Engineering *Pasadena, CA*

· Developing a physics-informed ML pipeline that **infers cell velocities from static histology** and integrates them with **spatial transcriptomics of human glioblastoma** to uncover gene–motility couplings in tumor progression.
· Led the creation of a **light-programmable microtubule–motor platform** that sculpts on-demand micron-scale flows for cell sorting, vesicle division and active mixing; first-author paper in *Nature Materials* (2025).
· Discovered a **geometry-controlled bifurcation** in the active healing of cytoskeletal networks; validated continuum theory with an elastic model.

Princeton University 2015 - 2021
Graduate Research Assistant, Mechanical & Aerospace Engineering *Princeton, NJ*

· Developed theory of **diffusiophoresis of charged droplets** and **autophoresis of interacting particles**.
· Revealed universal thinning and **self-healing of annular viscous films**; published in *Physical Review Letters*.
· Led a COVID-era study of **speech-driven aerosol transport**, generating joint space-and-time distancing guidelines.
· Collaborated with Princeton Plasma Physics Laboratory on **magneto-hydrodynamic stability** of liquid-metal films for fusion reactors.

Tsinghua University 2013 - 2015
Undergraduate Researcher, Mechanical Engineering *Beijing, China*

· Simulated electromagnetic stirring in continuous-casting processes.

TEACHING AND MENTORING

California Institute of Technology
Mentor for undergraduate Summer Undergraduate Research Fellowship (SURF): 2025 Summer

Princeton University
Assistant Instructor: MAE 305 Mathematics in Engineering, 2020 Fall
Assistant Instructor: MAE 305 Mathematics in Engineering, 2018 Fall

Assistant Instructor: MAE 335 Fluid Dynamics, 2018 Spring
Assistant Instructor: MAE 223 Modern Solid Mechanics 2017 Fall

PROFESSIONAL ACTIVITIES

Peer Reviewer: 2017 - Present
PNAS, *Journal of Fluid Mechanics*, *Physical Review Fluids*, *Physical Review E*, *Nuclear Materials and Energy.*

Application Reviewer:
Summer Undergraduate Research Fellowships (SURF) program, Caltech. 2022

Organizer (as a member of the organizing committee and chair of the plenary session):
9th Gotham-Metro Condensed Matter Meeting, New York University, NY. 2019

Professional Societies:
American Physical Society (APS)
American Institute of Chemical Engineers (AIChE)

FELLOWSHIPS AND AWARDS

Biology and Biological Engineering Divisional Fellowship: Caltech, 2022–2024
Wallace Memorial Fellowship: Princeton University, 2019
School of Engineering and Applied Science Award for Excellence: Princeton University, 2018
Guggenheim Second Year Fellowship: Princeton University, 2016
Sayre Award for Academic Excellence: Princeton University, 2016
George W. Riesz '50 *52 SEAS Fellowship: Princeton University, 2016
National Scholarship: Tsinghua University, 2013
Sinopec Scholarship: Tsinghua University, 2012

SEMINARS AND PRESENTATIONS

Active Healing of Microtubule-Motor Networks
77th Annual Meeting of the APS Division of Fluid Dynamics, Salt Lake City, Utah 2024
Dynamic Flow Control Through Active Matter Programming Language
76th Annual Meeting of the APS Division of Fluid Dynamics, Washington, DC 2023
Mixing and Stretching in Microfluidics with Active Matter
74th Annual Meeting of the APS Division of Fluid Dynamics, Phoenix, AZ 2021
The healing of a viscous annular thread and formation of an entrained bubble- fingerprints of dripping of a viscous film
72nd Annual Meeting of the APS Division of Fluid Dynamics, Seattle, WA 2019
Dripping of a Thin Viscous Film
71st Annual Meeting of the APS Division of Fluid Dynamics, Atlanta, GA 2018
Autophoresis of Two Particles with Surface Chemical Reactions
70th Annual Meeting of the APS Division of Fluid Dynamics, Denver, CO 2017
Diffusiophoresis of a Charged Drop
91st Colloid and Surface Science Symposium, New York City, NY 2017
Diffusiophoresis of a Charged Drop
69th Annual Meeting of the APS Division of Fluid Dynamics, Portland, OR 2016
Ion Transport and Rectification in a Charged Nanoscale Cone
68th Annual Meeting of the APS Division of Fluid Dynamics, Boston, MA 2015

REFERENCES

Dr. Matt Thomson, Postdoctoral Advisor — Caltech
mthomson@caltech.edu — Pasadena, CA
Professor of Computational Biology

Dr. Howard A. Stone, PhD Advisor — Princeton University
hastone@princeton.edu — Princeton, NJ
Neil A. Omenn '68 University Professor of Mechanical and Aerospace Engineering

Dr. Rob Phillips, Collaborator and Mentor — Caltech
phillips@pboc.caltech.edu — Pasadena, CA
Fred and Nancy Morris Professor of Biophysics, Biology, and Physics