RUI ZHANG

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EDUCATION

PhD Physics, City University of New York — Sep 2013
Graduate Center & City College, with Prof. Joel Koplik

BS Physics, Fudan University (China) — Jul 2007
Department of Physics

PROFESSIONAL EXPERIENCE

Assistant Professor — Mar 2020 - present
Department of Physics
The Hong Kong University of Science and Technology

Distinguished Research Associate — May 2018 - Mar 2020
Pritzker School of Molecular Engineering
The University of Chicago

Postdoctoral Scholar, with Prof. Juan J. de Pablo — Jan 2014 - May 2018
Pritzker School of Molecular Engineering
The University of Chicago

Research Assistant & Adjunct Lecturer — Sep 2009 - Dec 2013
Levich Institute & Physics Department
City College of New York

RESEARCH INTERESTS

Theoretical & Computational Soft Matter Physics: Liquid Crystals; Active Matter; Micro/Nanofluidics; Polymer Physics; Colloids; Mechanical Metamaterials.

PUBLICATIONS

1. **Rui Zhang***, Steven Redford*, Paul Ruijrok, Nitin Kumar, Ali Mozaffari, Sasha Zemsky, Aaron Dinner, Vincenzo Vitelli, Zev Bryant, Margaret Gardel and Juan J. de Pablo, Spatiotemporal Control of Liquid Crystal Structure and Dynamics Through Activity Patterning, *Nature Materials* **20**, 875-882 (2021).
2. Ali Mozaffari*, **Rui Zhang***, Noe Atzin and Juan J. de Pablo, Defect Spirograph: Dynamical Behavior of Defects in Spatially Patterned Active Nematics, *Phys. Rev. Lett.* **126**, 227801 (2021).
3. **Rui Zhang***, Ali Mozaffari* and Juan J. de Pablo, Autonomous Materials Systems for Active Liquid Crystals, *Nature Reviews Materials* **6**, 437-453 (2021).

4. Xin Wang, **Rui Zhang**, Ali Mozaffari, Juan J. de Pablo and Nicholas L. Abbott, Active Motion of Janus Droplets: Tuning Squirmer Behavior by Droplet Morphology, *Soft Matter* (2021).
5. Jonathan Colen, Ming Han, **Rui Zhang**, Steven A. Redford, Linnea M. Lemma, Link Morgan, Paul V. Ruijgrok, Raymond Adkins, Zev Bryant, Zvonimir Dogic, Margaret L. Gardel, Juan J. de Pablo and Vincenzo Vitelli, Machine learning active-nematic hydrodynamics, *Proc. Natl. Acad. Sci. U. S. A.* **118** (10) e2016708118 (2021). arXiv:2006.13203.
6. Bohdan Senyuk, Ali Mozaffari, Kevin Crust, **Rui Zhang**, Juan J. de Pablo and Ivan I. Smalyukh, Transformation between elastic dipoles, quadrupoles, octupoles and hexadecapoles driven by surfactant self-assembly in nematic emulsion, *Science Advances*, in press (2021).
7. Jake Shechter, Noe Atzin, Ali Mozaffari, **Rui Zhang**, Ye Zhou, Benjamin Strain, Linda Oster, Juan J. de Pablo, and Jennifer Ross, Direct Observation of Liquid Crystal Droplet Configurational Transitions using Optical Tweezers, *Langmuir* **36**, 25, 7074-7082 (2020).
8. Xiang Gao, Yuanwen Jiang, Yiliang Lin, Kyoung-Ho Kim, Yin Fang, Jaeseok Yi, Lingyuan Meng, Hoo-Cheol Lee, Zhiyue Lu, Owen Leddy, **Rui Zhang**, Qing Tu, Wei Feng, Vishnu Nair, Philip J. Griffin, Fengyuan Shi, Gajendra S. Shekhawat, Aaron R. Dinner, Hong-Gyu Park, Bozhi Tian, Structured silicon for revealing transient and integrated signal transductions in microbial systems, *Science Advances* **6**, eaay2760 (2020).
9. Monirosadat Sadati, Jose A. Martinez-Gonzalez, Ye Zhou, Nader Taheri Qazvini, Khia Kurtenbach, Xiao Li, Emre Bukusoglu, **Rui Zhang**, Nicholas L. Abbott, Juan Pablo Hernandez-Ortiz and Juan J. de Pablo, Prolate and Oblate Chiral Liquid Crystal Spheroids, *Science Advances* **6**, eaba6728 (2020).
10. Tadej Emersic*, **Rui Zhang***, Ziga Kos*, Simon Copar*, Natan Osterman, Juan J. de Pablo and Uros Tkalec, Sculpting phase-separated orientational domains in non-equilibrium anisotropic fluids, *Science Advances* **5**, eaav4283 (2019).
11. Andrey Sokolov*, Ali Mozaffari*, **Rui Zhang***, Juan J. de Pablo and Alexey Snezhko, Emergence of radial tree of elastic bands in active nematics, *Phys. Rev. X* **9** (3), 031014 (2019).
12. Ye Zhou, Bohdan Senyuk, **Rui Zhang**, Ivan Smalyukh, and Juan J. de Pablo, Degenerate conic anchoring and colloidal elastic dipole-hexadecapole transformations, *Nat. Commun.* **10**, 1000 (2019).
13. Jiachen Sun, **Rui Zhang**, Ling Feng, Christopher Monterola, Xiao Ma, Céline Rozenblat, H Eugene Stanley, Boris Podobnik, and Yanqing Hu, Extreme risk induced by communities in interdependent networks, *Communications Physics* **2** (1), 1-7 (2019).
14. **Rui Zhang***, Nitin Kumar*, Jennifer Ross, Margaret L. Gardel and Juan J. de Pablo, Interplay of Structure, Elasticity and Dynamics in Actin-Based Nematic Materials, *Proc. Natl. Acad. Sci. U. S. A.* **115** (2) E124-E133 (2018).
15. Nitin Kumar*, **Rui Zhang***, Juan J. de Pablo and Margaret L. Gardel, Tunable Structure and Dynamics of Active Liquid Crystals, *Science Advances* **4** (10), eaat7779 (2018).
16. Mohammad Rahimi, Hadi Ramezani-Dakhel, **Rui Zhang**, Abelardo Ramirez-Hernandez, Nicholas L. Abbott and Juan J. de Pablo, Segregation of liquid crystals mixture in topological defects, *Nat. Commun*. **8**, 15064 (2017).

17. Jose A. Martinez-Gonzalez, Xiao Li, Monirosadat Sadati, Ye Zhou, **Rui Zhang**, Paul Nealey and Juan J. de Pablo, Directed Self-Assembly of Liquid Crystalline Blue-Phases into Ideal Single-Crystals, *Nat. Commun*. **8**, 15064 (2017).
18. Xiao Li, Jose A. Martinez-Gonzalez, Juan P. Hernandez-Ortiz, Abelardo Ramirez-Hernandez, Ye Zhou, Monirosadat Sadati, **Rui Zhang**, Paul F. Nealey and Juan J. de Pablo, Mesoscale Martensitic Transformation in Single Crystals of Topological Defects, *Proc. Natl. Acad. Sci. U. S. A.* **114** 10011 (2017).
19. Hadi Ramezani-Dakhel, Monirosadat Sadati, **Rui Zhang**, Mohammad Rahimi, Khia Kurtenbach, Benoit Roux and Juan J. de Pablo, Water Flux-Induced Reorientation of Liquid Crystals, *ACS Central Science* **3** (12), 1345 (2017).
20. Xiaoguang Wang, Ye Zhou, Young-Ki Kim, Daniel S. Miller, **Rui Zhang**, Jose A. Martinez-Gonzalez, Emre Bukusoglu, Bo Zhang, Thaddeus M. Brown, Juan J. de Pablo and Nicholas L. Abbott, Patterned surface anchoring of nematic droplets at miscible liquid-liquid interfaces, *Soft Matter* **13**, 5714 (2017).
21. Monirosadat Sadati, Ye Zhou, Drew Melchert, Ashley Guo, Jose A. Martinez-Gonzalez, Tyler F. Roberts, **Rui Zhang** and Juan J. de Pablo, Spherical nematic shells with a prolate ellipsoidal core, *Soft Matter* **13**, 7465 (2017). Featured in cover art.
22. Chenhui Peng, Taras Turiv, **Rui Zhang**, Yubing Guo, Sergij V. Shiyanovskii, Qi-Huo Wei, Juan J. de Pablo and Oleg D. Lavrentovich, Controlling placement of nonspherical (boomerang) colloids in nematic cells with photopatterned director, *J. Phys.: Condens. Matter* **29**, 014005 (2017).
23. **Rui Zhang**, Ye Zhou, Mohammad Rahimi and Juan J. de Pablo, Dynamic structure of active nematic shells, *Nat. Commun*. **7**, 13483 (2016).
24. **Rui Zhang**, Ye Zhou, Jose A. Martinez-Gonzalez, Juan P. Hernandez-Ortiz, Nicholas L. Abbott and Juan J. de Pablo, Controlled deformation of vesicles by flexible structured media, *Science Advances* **2** (8), e1600978 (2016).
25. Ye Zhou, Emre Bukusoglu, Jose A. Martinez-Gonzalez, Mohammad Rahimi, Tyler F. Roberts, **Rui Zhang**, Xiaoguang Wang, Nicholas L. Abbott and Juan J. de Pablo, Structural transitions in Cholesteric Liquid Crystal droplets, *ACS Nano* **10** (7), 6484 (2016).
26. **Rui Zhang**, Tyler Roberts, Igor Aranson and Juan J. de Pablo, Lattice Boltzmann simulation of asymmetric flow in nematic liquid crystals with finite anchoring, *J. Chem. Phys*. **144**, 084905 (2016).
27. Ye Zhou, Ashley Guo, **Rui Zhang**, Julio C. Armas-Perez, Jose A. Martinez-Gonzalez, Mohammad Rahimi, Monirosadat Sadati and Juan J. de Pablo, Mesoscale structure of Chiral nematic shells, *Soft Matter* **12**, 8983 (2016). Featured in cover art.
28. Xiao Li, Julio C Armas-Perez, Jose A. Martinez-Gonzalez, Xiaoying Liu, He-Lou Xie, Camille E Bishop, **Rui Zhang**, Juan Pablo Hernandez-Ortiz, Juan J. de Pablo and Paul F. Nealey, Directed Self-Assembly of Nematic Liquid Crystals on Chemically Patterned Surfaces: Morphological States and Transitions, *Soft Matter* **12**, 8595 (2016).
29. **Rui Zhang**, Samaneh Farokhirad, Taehun Lee and Joel Koplik, Multiscale liquid drop impact on wettable and textured surfaces, *Phys. Fluids* **26**, 082003 (2014).
30. Chong Wu, Shenggong Ji, Rui Zhang, et al. Bootstrap Percolation on Complex Networks with Community Structure, *European Phys. Lett*. **107**, 4 (2014).
31. Weikang Chen, **Rui Zhang** and Joel Koplik, Velocity slip on curved surfaces, *Phys. Rev. E* **89**, 023005 (2013).

32. Yanqing Hu, Dong Zhou, **Rui Zhang** et al. Percolation of interdependent networks with intersimilarity, *Phys. Rev. E*. **88**, 052805 (2013).
33. Joel Koplik and **Rui Zhang**, Nanodrop Impact on Solid Surfaces, *Phys. Fluids* **25**, 022003 (2013).
34. **Rui Zhang** and Joel Koplik, Separation of Nanoparticles by Flow past a Patterned Substrate, *Phys. Rev. E* **85,** 026314 (2012).

* equal contribution.

RESEARCH GRANTS

PI, "*Multi Scale Study of Chiral Active Matter*", Hong Kong Research Grant Council (RGC) Early Career Scheme 26302320, 2020-2023.

Contributor, "*A Unified Framework for Description of Lyotropic and Active Liquid Crystals Far from Equilibrium*", NSF-DMR 1710318, 2017-2020.

MEDIA COVERAGE

"*Autonomous Materials Systems for Active Liquid Crystals*" published in *Nature Reviews Materials* is reported by HKUSTNews, EurekAlert and other news outlets.

"*Spatiotemporal Control of Liquid Crystal Structure and Dynamics Through Activity Patterning*" published in *Nature Materials* is highlighted by UChicagoNews.

"*Emergence of Radial Tree of Bend Stripes in Active Nematics*" published in *Physical Review X* is highlighted by UChicagoNews.

"*Controlled deformation of vesicles by flexible structured media*" published in *Science Advances*. is reported by UChicagoNews, ScienceDaily, phys.org and etc. Quotes from the UChicago report: "... The technique has potential for use in biology, medicine, and advanced materials development... The scientists built sophisticated models that produced this behavior on the computer and then reproduced it in the real world, testing the model's predictions."

"*Separation of nanoparticles by flow past a patterned substrate*" published in APS journal is highlighted in Physics Synopsis of APS.

PRESENTATIONS AND INVITED LECTURES

Invited Talks:

1. "Active Matter Meets Liquid Crystals: Searching for Building Blocks of Autonomous Materials", Department of Mechanical Engineering, Hong Kong Polytechnic University, May 2021.
2. "Design of Defects and Flows in Active Liquid Crystals", APS March Meeting, online, Mar 2021.

3. “Dynamics of Topological Defects in Active Liquid Crystals”, Physical Society of Hong Kong Annual Conference, Hong Kong, July 2020.
4. “Design of Active Nematic Systems”, APS March Meeting, Denver, Colorado, Mar 2020 (cancelled due to COVID-19 outbreak).
5. Oral presentation, “Control of Topological Defects in Engineered Active Liquid Crystals”, Gordon Research Seminar on Liquid Crystals, Colby-Sawyer College, New Hampshire, July 2019.
6. Invited seminar, Department of Physics, Chinese University of Hong Kong, Hong Kong, May 2019.
7. Invited seminar, Department of Physics, Hong Kong University of Science and Technology, Hong Kong, March 2019.
8. Invited webinar, Department of Physics, Dalhousie University, Canada, Mar 2019.
9. Invited seminar, Department of Chemical & Biological Engineering, University of New Mexico, Albuquerque, New Mexico, Feb 2019.
10. Invited seminar, Department of Physics, Virginia Tech, Blacksburg, Virginia, Jan 2019.
11. Invited seminar, Department of Physics, Southern University of Science and Technology, Shenzhen, China, May 2018.
12. Invited seminar, Institute of Theoretical Physics, Chinese Academy of Sciences, Beijing, China, May 2018.
13. Invited seminar, Center for Quantitative Biology, Zhejiang University, Hangzhou, China, May 2018.
14. Invited seminar, Institute of Natural Science, Shanghai Jiao Tong University, Shanghai, China, May 2018.
15. Invited seminar, College of Engineering & ZJU-UIUC Institute, University of Illinois at Urbana-Champaign, Urbana-Champaign, Illinois, May 2017.

Contributed talks:

16. **Rui Zhang**, et al. "Control of Topological Defects and Spontaneous Flows in Engineered Active Liquid Crystals", APS March Meeting 2019, Boston, Massachusetts, Mar 2019.
17. **Rui Zhang** and Juan J. de Pablo, "A Unified Model Reveals the Interfacial Structure and Dynamics of Lyotropic and Multiphase, Thermotropic Liquid Crystals", APS March Meeting 2018, Los Angeles, California, Mar 2018.
18. **Rui Zhang**, Nitin Kumar, Jenifer Ross, Margaret Gardel and Juan J. de Pablo, "Active Nematic Liquid Crystals with Variable Activity and Elasticity", AIChE Annual Conference 2017, Minneapolis, Minnesota, Nov 2017.
19. **Rui Zhang**, Nitin Kumar, Margaret Gardel and Juan J. de Pablo, "The static and dynamic behaviors of the topological defects in a nematic liquid crystal reveal its material characteristics", APS March Meeting 2017, New Orleans, Louisiana, March 2017.
20. **Rui Zhang**, Nitin Kumar, Jennifer Ross, Margaret Gardel and Juan J. de Pablo, "Topological defects in passive and active nematic liquid crystals", poster, Gordon Conference of Complex Active & Adaptive Material Systems, Ventura, California, Jan 2017.
21. **Rui Zhang**, Nitin Kumar, Margaret Gardel and Juan J. de Pablo, "Active matter, a liquid crystal point of view", NSF MRSEC Chicago Center IRGII student meeting, Chicago, Illinois, Nov 2016.

22. **Rui Zhang**, "Hydrodynamic model of structured liquids", American Institute of Chemical Engineers annual conference, San Francisco, California, Nov 2016.
23. **Rui Zhang**, Ye Zhou, Mohammad Rahimi and Juan J. de Pablo, "Dynamic structure of active nematic shells", International Liquid Crystal Conference, Kent State University, Ohio, Aug 2016.
24. **Rui Zhang**, "Active liquid-crystalline biomaterials: theory, simulation and predicted non-linear behavior", The University of Chicago Nano Talk III, Chicago, Illinois, Aug 2016.
25. **Rui Zhang**, Ye Zhou, Mohammad Rahimi and Juan J. de Pablo, "Active nematics confined within a shell", APS March Meeting 2016, Baltimore, Maryland, March 2016.
26. **Rui Zhang**, Tyler Roberts and Juan J. de Pablo, "Lattice Boltzmann simulations of asymmetric Liquid Crystal flow in hybrid cell with finite anchoring conditions", poster, Gordon Research Conference on Liquid Crystals, University of New England, Biddeford, Maine, June 2015.
27. **Rui Zhang** and Juan J. de Pablo, "Nano Liquid Crystal Droplet Impact on Solid Surfaces", APS March Meeting 2015, San Antonio, Texas, March 2015.
28. **Rui Zhang**, Tyler Roberts and Juan J. de Pablo, "Lattice Boltzmann simulations of liquid crystal particulate flow in a channel with finite anchoring boundary conditions", 67th Annual Meeting of the APS Division of Fluid Dynamics, San Francesco, California, Nov 2014.
29. **Rui Zhang** and Joel Koplik, "Simulations of drop transport through obstacle arrays", 66th Annual Meeting of the APS Division of Fluid Dynamics, Pittsburgh, Pennsylvania, Nov 2013.
30. **Rui Zhang**, Tak Shing Lo, Kevin Connington and Joel Koplik, "Simulations of Drop Transport Through Obstacle Arrays", CCNY Levich Institute Seminar, New York, New York, Nov 2013.
31. **Rui Zhang**, Samaneh Farokhirad, Taehun Lee and Joel Koplik, "Multiscale liquid drop impact on wettable and textured surfaces", Northeast Complex Fluids and Soft Matter Workshop, Rutgers University, Piscataway, New Jersey, Oct 2013.
32. **Rui Zhang** and Joel Koplik, "Nanodrop impact on rough and textured surfaces", 65th Annual Meeting of the APS Division of Fluid Dynamics, San Diego, California, Nov 2012.
33. Joel Koplik and **Rui Zhang**, "Bouncing, splashing and disintegrating nanodrops", 65th Annual Meeting of the APS Division of Fluid Dynamics, San Diego, California, Nov 2012.
34. **Rui Zhang** and Joel Koplik, "Transport of nonaparticles flowing past a patterned substrate", 64th Annual Meeting of the APS Division of Fluid Dynamics, Baltimore, Maryland, Nov 2011.
35. **Rui Zhang** and Joel Koplik, "Separation of nanoparticles by flow past a patterned substrate", 63th Annual Meeting of the APS Division of Fluid Dynamics, Long Beach, California, Nov 2010.

HONORS

Fudan University "Wang Dao" Fellowship, 2007.

PROFESSIONAL SERVICES

Journal Reviewer: *Physical Review Letters; Science Advances; Langmuir; Physical Review E; Journal of Physics: Condensed Matter; PLOS One; Computers and Fluids; Physica A; Physica D; Polymer; Soft Materials; Scientific Reports; Molecular Simulation; Frontiers in Physics*.

Journal Advisory Board: *Journal of Physics: Condensed Matter* (2019 - present).

Search Committee Member of Center for Computational Science of HKUST(GZ) 2021-present.

Membership: American Physical Society (APS); American Institute of Chemical Engineers (AIChE).

Judge for the Undergraduate Poster Competition in 2016 AIChE Conference.

REFERENCES

Professor **Juan J. de Pablo**, Postdoc Advisor
Member of National Academy of Engineering; Fellow of American Academy of Arts and Sciences; Fellow of American Physical Society
Institute for Molecular Engineering, The University of Chicago
Email: depablo@uchicago.edu
Phone: (773) 702-7791

Professor **Joel Koplik**, Ph.D. Advisor
Levich Institute and Physics Department, City College of New York
Email: jkoplik@ccny.cuny.edu
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Professor **Margaret L. Gardel**
James Frank Institute and Physics Department, The University of Chicago
Email: zenaa@uchicago.edu
Phone: (773) 834-5871

Professor **Vincenzo Vitelli**
Fellow of American Physical Society; Kavli Frontiers of Science Fellow
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Phone: (773) 834-8829