Perry W.M. Ellis

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EMPLOYMENT

Harvard University, Cambridge, MA
Postdoctoral Fellow — September 2018 – Present
Advisor: David. A Weitz

EDUCATION

Georgia Institute of Technology, Atlanta, GA
Ph.D., Physics, G.P.A. 3.9/4.0 — May 2018
Advisor: Alberto Fernandez-Nieves
Dissertation: *Nematic materials in curved spaces*

Master of Science, Physics, G.P.A 3.9/4.0 — December 2012

Harvey Mudd College, Claremont, CA
Bachelor of Science, Physics, G.P.A. 3.4/4.0 — May 2011

Study Abroad
University of Granada, Granada, Spain — Spring 2010

HONORS AND AWARDS

Sigma Xi Research Award - Best PhD Thesis, Georgia Institute of Technology, 2019 • FLAMEL Doctoral Fellowship, Georgia Institute of Technology, Fall 2015 – Summer 2017 • Member, Gamma Beta Phi, Georgia Institute of Technology Chapter, Summer 2012 – Spring 2014 • National Merit Scholar, 2007 – 2011 • Harvey Mudd Merit Scholarship, 2007 – 2011 • Harvey Mudd College Dean's List, Spring 2008, 2009, 2011, Fall 2009, 2010

PUBLICATIONS

DJG Pearce, J. Nambisan, P.W. Ellis, A. Fernández-Nieves, L. Giomi, *Orientational correlations in active and passive nematic defects*, PRL. **127**, 197801 (2021)

P.W. Ellis, J. Nambisan, A. Fernández-Nieves, *Coherence-enhanced diffusion filtering applied to partially-ordered fluids*, Molecular Physics. **118**, e1725167 (2020)

P.W. Ellis, S. Klaneček, A. Fernández-Nieves, *Polarized epifluoresence microscopy and the imaging of nematic liquid crystals in highly curved geometries*, PRE. **101**, 052703 (2020)

D.J.G. Pearce, P.W. Ellis, A. Fernández-Nieves, L. Giomi *Geometrical control of active turbulence in curved topographies*, PRL. **122**, 168002 (2019)

P.W. Ellis, A. Fernández-Nieves, *Polarized optical microscopy textures of nematic liquid crystal tori*, JPhys D. **52**, 213001 (2019)

J.P. McInerney, P.W. Ellis, D.Z. Rocklin, A. Fernández-Nieves, E.A. Matsumoto, *Curved boundaries and chiral instabilities — two sources of twist in homeotropic nematic tori*, Soft Matter. (2019)

P.W. Ellis, K. Nayani, J.P. McInerney, D.Z. Rocklin, M. Srinivasarao, E.A. Matsumoto, A. Fernández-Nieves, *Curvature-induced twist in homeotropic nematics*, PRL. **121**, 247803 (2018)

P.W. Ellis, S. Huang, S. Klaneček, J. Vallamkondu, E. Dannemiller, M. Vernon, Y.W. Chang, P.M. Goldbart, A. Fernández-Nieves, *Defect transitions in nematic liquid crystal capillary bridges*, PRE. **97**, 040701(R) (2018)

P.W. Ellis, D.J.G. Pearce, Y.W. Chang, G. Goldsztein, L. Giomi, A. Fernández-Nieves, *Curvature-induced defect unbinding and dynamics in active nematic toroids*, Nat. Phys. **14**, 85 (2018)

K. Nayani, R. Chang, J. Fu, P.W. Ellis, A. Fernández-Nieves, J.O. Park, M. Srinivasarao, *Spontaneous emergence of chirality in achiral lyotropic chromonic liquid crystals confined to cylinders*, Nat. Comm. **6**, 8067 (2015)

A. Fragkopoulos, P.W. Ellis, A. Fernández-Nieves, *Teaching Rayleigh-Plateau instabilities in the lab*, EJP. **36**, 055023 (2015)

E. Pairam, J. Vallamkondu, V. Koning, B. C. van Zuiden, P. W. Ellis, M. A. Bates, V. Vitelli, A. Fernández-Nieves, *Stable nematic droplets with handles*, PNAS. **110**, 9295 (2013)

PRESENTATIONS

Better organoids through homogeneity. P.W. Ellis, G. Anand, Y.I. Yaman, D.A. Weitz, S. Ramanathan. ISCCR 2020 Annual Meeting, Virtual Conference, June 23, 2020. Poster Presentation

Active nematics on a toroid: exploring the interactions between order, curvature, and activity. P.W. Ellis, J. Nambisan, A. Fernandez-Nieves. Physics Colloquium, University of Massachusetts—Boston, November 1, 2019. Oral Presentation

Active nematics on the surface of a toroid. P.W. Ellis, A. Fernandez-Nieves. Squishy Physics Seminar, Harvard University, October 10, 2019. Oral Presentation

Defects in an active nematic confined to a toroid. P.W. Ellis, D. Pearce, L. Giomi, and A. Fernandez-Nieves. Soft Matter Forefronts, Georgia Institute of Technology, April 18, 2019. Oral Presentation

Defects in an active nematic confined to a toroid. P.W. Ellis, D. Pearce, L. Giomi, and A. Fernandez-Nieves. APS March Meeting, March 8, 2018. Oral Presentation

Defects in an active nematic confined to a toroid. P.W. Ellis, D. Pearce, L. Giomi, and A. Fernandez-Nieves. APS March Meeting, March 16, 2017. Oral Presentation

Defect unbinding in active nematic toroids. P.W. Ellis, Y.W. Chang, and A. Fernandez-Nieves. ACS Colloids and Surface Science Symposium, June 6, 2016. Oral Presentation

Active nematics on the surface of as torus. P.W. Ellis, Y.W. Chang, and A. Fernandez-Nieves. APS March Meeting, March 14, 2016. Oral Presentation

Simulated textures of toroidal nematic liquid crystal droplets. P.W. Ellis and A. Fernandez-Nieves. ACS Colloids and Surface Symposium, June 2014. Poster Presentation

Simulated textures of toroidal nematic liquid crystal droplets. P.W. Ellis and A. Fernandez-Nieves. APS March Meeting, March 4 2014. Oral Presentation

Simulating nematic textures using Jones Matrices. P.W. Ellis and A. Fernandez-Nieves. Soft matter bag lunch, Georgia Institute of Technology, November 13 2013. Oral Presentation

PROJECT AND RESEARCH EXPERIENCE

Postdoctoral Fellow, Harvard University, Cambridge, MA — Jan 2022 – Present

- Develop a droplet microfluidic workflow for deep mutational scanning of enzymes
- Design and optimize multi-injector picoinjection chip
- Categorize mutations as deleterious, neutral, or beneficial for a library of 10^6 mutations in under an hour.

Postdoctoral Fellow, Harvard University, Cambridge, MA Fall 2019 – Present
- Develop a high-throughput droplet microfluidic workflow to improve organoid homogeneity
- Design and validate encapsulation, droplet sorting, and organoid deposition protocols and chips compatible with human embryonic stem cells and primary cell lines
- Sort potential organoids based on starting cell composition and deposit organoids for long-term culture

Postdoctoral Fellow, Harvard University, Cambridge, MA Jan 2021 – Present
- Investigate the role of droplet size in a digital-droplet-LAMP (ddLAMP) assay for SARS-CoV-2
- Design and build a detection setup to record real-time amplification for ddLAMP
- Convert standard real-time-LAMP assays to be compatible with ddLMAP.
- Publication in preparation

Postdoctoral Fellow, Harvard University, Cambridge, MA Fall 2019 – Present
- Develop a droplet microfluidic assay to screen and sort cytotoxic bacteria from a mixed bacterial sample.
- Design and build a droplet sorting stand with 5 fluorescent channels and custom operating software.
- Design and optimize a microfluidic chip to robustly sort large droplets at high throughput
- Publication in preparation

Graduate Researcher, Georgia Institute of Technology, Atlanta, GA Spring 2015 – Spring 2018
- Use fluorescence confocal microscopy to study an active nematic liquid crystal confined to a toroidal surface
- See defect density dependence on the local Gaussian curvature, the activity, and the toroid aspect ratio
- See curvature-induced defect unbinding in the time-averaged defect charge

Graduate Researcher, Georgia Institute of Technology, Atlanta, GA Fall 2014 – Spring 2018
- Investigate nematic liquid crystal confined to a toroidal droplet with homeotropic boundary conditions
- Use optical microscopy and simulation to investigate the role of curvature in the defect and director configuration
- Find a structural transition away from an escaped radial configuration depending on the aspect ratio of the toroidal droplet

Graduate Researcher, Georgia Institute of Technology, Atlanta, GA Spring 2014 – Spring 2018
- Investigate nematic liquid crystal confined between parallel plates with variable separation
- Use polarized microscopy, fluorescence microscopy, and simulation to determine defect structure and type as a function of plate separation and droplet volume
- Find a transition between a ring defect and a point defect depending on bridge aspect ratio
- Find that the Gaussian curvature of the free surface of the liquid crystal determines the sign of the defect

Graduate Researcher, Georgia Institute of Technology, Atlanta, GA Fall 2012 – Spring 2018
- Simulate nematic textures based on a given director field and confining geometry.
- Used simulation in conjunction with experimental results to confirm a director hypothesis for toroidal nematic liquid crystal droplets.

Lawrence Livermore National Laboratory Clinic Team, Claremont, CA Fall 2010 – Spring 2011
- Developed a test bed to evaluate the photocathode for a dynamic transmission electron microscope in order to overcome limiting factors in the current setup.
- Served as team leader: managed the four-person team and interacted with the project liaisons.

TEACHING EXPERIENCE

Graduate Teaching Assistant, Georgia Institute of Technology, Atlanta, GA Fall 2013 – Spring 2014
- Develop a laboratory section for a future graduate course in Soft Condensed Matter.
- Designed lab experiments to introduce the student to important broad concepts in Soft Condensed Matter while developing critical thinking and experimental technique.

Graduate Teaching Assistant, Georgia Institute of Technology, Atlanta, GA Spring 2013 – Summer 2013
- Developed a laboratory section for a future class, P21CS, Physics for 21^{st} Century Students.
- Designed course to impart an intuitive understanding of basic physics concepts relevant for the modern citizen without focusing on the math.

Graduate Teaching Assistant, Georgia Institute of Technology, Atlanta, GA Fall 2012
- Lectured, held office hours, and graded homework and exams for Physics 3141, Thermodynamics.

Graduate Teaching Assistant, Georgia Institute of Technology, Atlanta, GA Fall 2011 – Summer 2011
- Taught laboratory and recitation sections, tutored students, and graded exams for Physics 2211, Calculus-based Mechanics.

Graduate Teaching Assistant, Scripps College, Claremont, CA Summer 2011
- Assisted with laboratory sessions, tutored students, and graded homework assignments for General Physics 31, Calculus-based Electricity and Magnetism.

SERVICE

Professional Service

Journal referee, Fall 2018 – Present
- Served as referee for Physical Review Letters, Physical Review E, and Journal of Molecular Liquids
- Evaluated submitted manuscripts for scientific merit, clarity, and validity

PURA reviewer, Georgia Institute of Technology, Atlanta, GA Spring 2013 - Spring 2018
- Reviewed applicants for the President's Undergraduate Research Awards (PURA), a program funding undergraduate research under a faculty mentor.
- Evaluated applications on scientific merit, student ability, and faculty endorsement of the student.

Community Service

Member of Gamma Beta Phi, Georgia Institute of Technology, Atlanta, GA Summer 2012 – Spring 2014
- A national honor society focused on community service.

HOBBIES

Cooking • Rock Climbing • Brazilian Jiu-Jitsu • Tabletop Games • Water Polo • Hiking • Swimming