Tali Khain

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University of Chicago, Department of Physics

Education

University of Chicago — **Chicago, IL**
Ph.D. Candidate in Physics — *October 2019 - present*

University of Michigan — **Ann Arbor, MI**
B.S. in Honors Physics, Honors Mathematics — *September 2015 - May 2019*

Publications

15. **Khain, T.**, Fruchart, M., Scheibner, C., Witten, T. A., Vitelli, V., "Trading particle shape with fluid symmetry: on the mobility matrix in 3D chiral fluids", arXiv:2310.17528
14. **Khain, T.**, Fruchart, M., Vitelli, V., "Viscous tweezers: controlling particles with viscosity", arXiv:2307.04948
13. de Wit, X. M., Fruchart, M., **Khain, T.**, Toschi, F., Vitelli, V., "Pattern formation by turbulent cascades", 2024, *Nature*, 627, 515-521
12. **Khain, T.**, Scheibner, C., Fruchart, M., Vitelli, V., "Stokes flows in three-dimensional fluids with odd and parity-violating viscosities", 2022, *Journal of Fluid Mechanics*, 934
11. **Khain, T.**, Becker, J. C., Adams, F., "The resonance hopping effect in the Neptune-Planet Nine system", 2020, *Publications of the Astronomical Society of the Pacific*, 132, 124401
10. **Khain, T.**, Becker, J. C., Lin, H.W., et al. "Dynamical classification of trans-Neptunian objects detected by the Dark Energy Survey", 2020, *Astronomical Journal*, 159, 133
9. Ankney, N., Avery, M., **Khain, T.**, & Scheel, A. "Pinning and depinning: from periodic to chaotic and random media", 2019, *Chaos*, 29, 013127
8. Lin, H.W., Gerdes, D. W., et al. including **Khain, T.**, "Evidence for color dichotomy in the primordial Neptunian Trojan population", 2019, *Icarus*, 321, 426
7. **Khain, T.**, Becker, J. C., Adams, F., et al. "Dynamical analysis of three distant trans-Neptunian objects with similar orbits", 2018, *Astronomical Journal*, 156, 273
6. Rodriguez, J. E., Becker, J. C., et al. including **Khain, T.**. "A compact multi-planet system with a significantly misaligned ultra short period planet", 2018, *Astronomical Journal*, 156, 245
5. Becker, J. C., **Khain, T.**, Hamilton, S. J., Adams, F., et al. "Discovery and dynamical analysis of an extreme trans-Neptunian object with a high orbital inclination", 2018, *Astronomical Journal*, 156, 81
4. **Khain, T.**, Batygin, K., Brown, M. E., "The generation of the distant Kuiper belt by Planet Nine from an initially broad perihelion distribution", 2018, *Astronomical Journal*, 155, 250
3. Becker, J. C., Vanderburg, A., Adams, F., **Khain, T.**, & Bryan, M. "Exterior companions to hot Jupiters orbiting cool stars are coplanar", 2017, *Astronomical Journal*, 154, 230
2. Becker, J. C., Adams, F., **Khain, T.**, Hamilton, S., & Gerdes, D. "Evaluating the dynamical stability of outer solar system objects in the presence of Planet Nine", 2017, *Astronomical Journal*, 154, 61
1. Gerdes, D., Sako, M., Hamilton, S., Zhang, K., **Khain, T.**, et al. "Discovery and physical characterization of a large scattered disk object at 92 au", 2017, ApJL, 839, L15

Awards

Emerging Soft Matter Excellence Award, *American Physical Society Division of Soft Matter* **2024**
National Science Foundation Graduate Research Fellowship **2019 - present**
Yoichiro Nambu Fellowship, *University of Chicago Department of Physics* **2019 - present**
LeRoy Apker Award, *American Physical Society* **2019**
Williams L. Williams Thesis Award, *University of Michigan Department of Physics* 2019
Jerome and Isabella Karle Physical Sciences Award, *University of Michigan LSA Honors Program* 2019
Wilfred Kaplan Award in Applied Mathematics, *University of Michigan* 2019
Wirt and Mary Undergraduate Cornwell Prize, *University of Michigan Department of Physics* 2019
Donald J. Lewis Mathematical Merit Scholar Award, *University of Michigan* 2019
Barry Goldwater Scholar **2018**
Astronaut Scholar **2018**
Department of Mathematics Alumni Scholarship, *University of Michigan* 2018
Otto Graf Scholarship, *University of Michigan LSA Honors Program* 2018
Dahlin Memorial Award, *University of Michigan Department of Physics* 2018
Raynor L. Duncombe Prize for Student Research, *Division on Dynamical Astronomy* 2018
Hartmann Student Travel Grant, *American Astronomical Society* 2017
Gassin Family LSA Merit Scholarship, *University of Michigan* 2015
M.S. Keeler Department of Mathematics Merit Scholarship, *University of Michigan* 2015
Regents Merit Scholarship, *University of Michigan* 2015
Elks National Foundation Scholarship 2015

Conferences and Seminars

24. **APS March Meeting 2024**, Minneapolis, MN (March 2024); "The wake of a sphere in a chiral fluid" (contributed talk in the Emerging Soft Matter Excellence Award session)
23. **Coffee Seminar**, PMMH lab, ESPCI, Paris, France (February 2024); "The simplest complex fluids" (invited talk)
22. **Soft Interfaces Lab Meeting**, Gulliver lab, ESPCI, Paris, France (February 2024); "The simplest complex fluids" (invited talk)
21. **Journées de Physique Statistique**, Paris, France (January 2024); "Sedimentation in a chiral fluid" (contributed talk)
20. **APS Division of Fluid Dynamics**, Washington D.C. (November 2023); "Viscous tweezers: controlling particles with viscosity" (contributed talk)
19. **Wednesday Lunch Seminar**, Technical University of Eindhoven, Eindhoven, The Netherlands (March 2023); "Drifting and twirling in a 3D chiral fluid" (invited talk)
18. **CECAM Workshop "Emerging colloidal dynamics away from equilibrium. Chiral active systems."**, Lausanne, Switzerland (March 2023); "Drifting and twirling in a 3D chiral fluid" (invited talk)
17. **APS Division of Fluid Dynamics**, Indianapolis, IN (November 2022); "Drifting and twirling in a chiral active fluid at low Reynolds number" (contributed talk)
16. **Boulder Summer School "Hydrodynamics Across Scales"**, Boulder, CO (July 2022); "Stokes flow in three-dimensional fluids with odd and parity-violating viscosities" (poster)
15. **APS March Meeting 2022**, Chicago, IL (March 2022); "Sedimentation in a chiral fluid with odd viscosity" (contributed talk)

14. **APS Division of Fluid Dynamics**, Phoenix, AZ (November 2021); "Sedimentation in a chiral fluid with odd viscosity" (contributed talk)
13. **APS March Meeting 2021**, virtual conference; "Odd viscosity in Stokes flows" (contributed talk)
12. **APS Division of Fluid Dynamics**, virtual conference (November 2020); "Odd viscosity in three-dimensional flows" (contributed talk)
11. **APS March Meeting 2020**, Denver, CO; "Dynamics of the outer solar system: from Neptune to Planet Nine", moved to March Meeting 2021 due to COVID-19 (APS Apker Award talk)
10. **Dynamics Days**, Evanston, IL (January 2019); "Dynamical stability of the outer solar system in the presence of Planet Nine" (flash talk and poster)
9. **Astronaut Scholarship Foundation Technical Conference**, Washington, D.C. (August 2018); "... A new planet in the outer solar system?" (invited talk)
8. **Planet Nine Workshop**, Pasadena, CA (May 2018); "Planet Nine and the evolution of the distant Kuiper belt" (invited talk)
7. **49th Annual Meeting of the Division on Dynamical Astronomy**, American Astronomical Society, San Jose, CA (April 2018); "Planet Nine and the evolution of the distant Kuiper belt" (contributed talk)
6. **Society of Physics Students Zone Meeting**, Ann Arbor, MI (January 2018); "The outer solar system in the presence of Planet Nine" (contributed talk)
5. **49th Annual Meeting of the Division for Planetary Sciences**, American Astronomical Society, Provo, UT (October 2017); "Dynamics of a possible collisional family of extreme TNOs" (poster)
4. **Student-Faculty Programs, Summer Seminar Day**, Caltech, Pasadena, CA (August 2017); "The generation of the distant Kuiper belt by Planet Nine" (contributed talk)
3. **2017 American Physical Society sponsored Conference for Undergraduate Women in Physics (CUWiP)**, Wayne State University, Detroit, MI (January 2017); "The orbital dynamics of new trans-Neptunian objects in the solar system" (contributed talk)
2. **Graduate Research Opportunities for Women (GROW) Mathematics Conference**, Northwestern University, Evanston, IL (October 2016); attended
1. **Ann Arbor Trans-Neptunian Object Workshop**, University of Michigan, Ann Arbor, MI (June 2016); "Classification of trans-Neptunian objects" (contributed talk)

Summer Schools

"Complex Motion in Fluids", Cambridge, UK *July 2023*
"Hydrodynamics Across Scales", Boulder, CO *July 2022*

Service and Outreach Activities

APS DSOFT Student Activities Committee: Member *2022 - present*

Organized events for graduate students and postdocs in the soft matter discipline, including research spotlight seminars, March Meeting panels, industry panels, and more.

Physical Review Fluids: Referee *2022 - present*
UChicago Physics Mentorship Program: Organizer and Mentor *2019 - present*

Paired mentors and mentees, facilitated mentorship meetups, and organized events. Mentored undergraduate students interested in physics; helped with deciding on coursework, applying for summer opportunities, and more.

Science Event Volunteer *2019 - present*

Volunteered at full-day science outreach events throughout the year, including the South Side Science Festival and Physics with a Bang.

Math Team Coach *2021*

Developed practice materials and coached a team of middle-school girls for a math olympiad called GAIM (Girls' Adventures in Math).

Museum of Science and Industry (Chicago): Science Connections Volunteer *2019 - 2021*

Introduced museum guests of all ages to an exhibit on gravity through hands-on activities and live demonstrations; interview and training were required for position.

U-M Women in Math Club: President, Board Member *2015 - 2019*

Led student organization that offers social and professional support to women and other underrepresented minorities in mathematics and related fields; planned and ran professional development events (REU Panel, LaTex Workshop, Graduate School Panel, CV/Resume Workshop) and social events (kayaking, tie-dying, apple-picking).

U-M FEMMES: Secretary, Capstone Activities Coordinator *2015 - 2019*

Held leadership positions in student-led organization that encourages middle-school female students to learn and explore their potential in science, technology, math and engineering. Organized a capstone event every semester for hundreds of middle schoolers from across Southeast Michigan.

U-M MMATHS: Co-Organizer *2016 - 2019*

National high school math competition that is held simultaneously at major universities; planned and ran the first such event at U-M, had over 100 high school students participate from all over Michigan!

WESO (Washtenaw Elementary Science Olympiad): Event Supervisor *2016 - 2019*

Planned and supervised a physics zip-line event for local elementary school students.

Public Talks (Invited)

- "A new planet in the outer solar system: the Kuiper belt and beyond", University of Michigan Student Astronomical Society Meeting, Ann Arbor, MI (April 2019)
- "...A new planet in the outer solar system?", Mill Creek Middle School, Dexter, MI (December 2018)

Teaching Experience

Math and Science Tutor *2020 - 2021*

Developed, planned, and taught an advanced extracurricular science and math curriculum for a middle school student

Course assistant for U-M Honors Calculus I, II, III *September 2016 - December 2018*

Held weekly office hours, graded homework, facilitated in-class group work.

Tutor at Mathnasium *Summer 2015*

Taught math to children of ages 5-11.

Professional Memberships

American Physical Society 2016 - present
American Astronomical Society 2017 - 2020

Skills

Programming: proficient in Python, MATLAB and Mathematica, working knowledge of HTML, CSS.

Leadership: experience in leading activities, coordinating events, and working with kids of all ages; excellent organizational skills.

Languages: fluent in Russian, proficient in Hebrew, Latin.

Music: eleven years of piano, eight years of flute. Member of UChicago Chamber Orchestra (flute).

Hobbies: reading, arts & crafts, knitting, hiking, figure skating, cross-country skiing.