

Paul Apisa

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RESEARCH INTERESTS Teichmüller dynamics, Flat geometry, Homogeneous dynamics, Mapping class and braid groups

EMPLOYMENT & EDUCATION **University of Michigan, Department of Mathematics**
Postdoctoral Fellow **July 2020 - present**

Yale University, Department of Mathematics
Gibbs Assistant Professor **July 2019 - July 2020**
Postdoctoral Fellow **July 2018 - June 2019**

The University of Chicago, Department of Mathematics **Advisor: Alex Eskin**
Ph.D. - Thesis: Dynamics on the moduli space of translation surfaces **June 2018**
M.S. **September 2014**

The Ohio State University
Bachelor of Science in Mathematics; with distinction and honors research distinction **June 2012**

PAPERS

1. $GL(2, \mathbb{R})$ orbit closures in hyperelliptic components of strata.
Duke Math J. (2018), Vol. 167, No. 4, 679-742
2. Rank one orbit closures in $\mathcal{H}^{hyp}(g-1, g-1)$.
Geom. Funct. Anal. (GAFA) 29 (2019), no. 6, 1617-1637
3. $GL(2, \mathbb{R})$ -invariant measures in marked strata: Generic marked points, Earle-Kra for strata, and illumination.
Geom. Topol. 24 (2020), no. 1, 373-408.
4. A generalization of the Burnside basis theorem (with Benjamin Klopsch).
J. of Alg. 400 (2014), 8-16.
5. Divergent on average directions of Teichmüller geodesic flow (with Howard Masur).
accepted to JEMS, available at <https://arxiv.org/abs/1803.00093>
6. Exceptional directions for the Teichmüller geodesic flow and Hausdorff dimension (with Hamid al-Saqban, Alena Erchenko, Osama Khalil, Shahriar Mirzadeh, and Caglar Uyanik).
accepted to JEMS, available at <https://arxiv.org/pdf/1711.10542>
7. Marked points on translation surfaces (with Alex Wright).
accepted to Geom. Topol., available at <https://arxiv.org/abs/1708.03411>
8. Periodic points in genus two: Holomorphic sections over Hilbert modular varieties, Teichmüller dynamics, and billiards.
preprint, (2017), available at <https://arxiv.org/abs/1710.05505>
9. Periodic points on the regular and double n -gon surfaces (with Rafael Saavedra and Christopher Zhang).
preprint (2020), available at <https://arxiv.org/abs/2011.02668>
10. Reconstructing orbit closures from their boundaries (with Alex Wright)
preprint (2020), available at <https://arxiv.org/abs/2011.08807>
11. Generalizations of the Eierlegende-Wollmilchsau (with Alex Wright)
preprint (2020), available at <https://arxiv.org/abs/2011.09452>
12. High rank invariant subvarieties (with Alex Wright)
preprint (2021), available at <https://arxiv.org/abs/2102.06567>
13. Invariant subvarieties of minimal homological dimension, zero Lyapunov exponents, and monodromy
preprint (2021)
14. Groups with the universal mapping property.
Bachelor's Honors Thesis, available at <http://hdl.handle.net/1811/52079>

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| AWARDS | 2018 - present | NSF Mathematical Sciences Postdoctoral Research Fellowship |
| | 2013 - 2018 | NSF Graduate Research Fellowship |
| | 2012 - 2013 | McCormick Graduate Fellowship (University of Chicago) |
| | 2011 | Ohio State University (OSU) Undergraduate Research Scholarship <i>Awarded for Bachelor's Honors Thesis</i> |
| | 2009 - 2011 | Rickard, Tumbleson, and Goldstein Scholarships <i>OSU merit scholarships in mathematics, awarded in 2009, 2010, and 2011 resp.</i> |
| | 2009 | Phi Beta Kappa Induction |
| INVITED TALKS AND | Jan.-Feb. 2021 | Pacific Dynamics Winter 2021 Seminar Series Five part seminar series given with Alex Wright. |
| | September 2020 | BiSTRO - Billiards and Surfaces la Teichmüller and Riemann, Online |
| MINI-COURSES | May 2020 | Harvard Informal Geometry and Dynamics Seminar Nearly Carbon Neutral Geometry and Topology Conference |
| | October 2019 | Boston College Dynamics Seminar |
| | September 2019 | University of Maryland Dynamics Seminar Mini-course on the Moduli Space of Translation Surfaces at Symbolic Tools in Mathematics and their Application - Around Moduli Spaces Joint program of Saarbrücken, Kaiserslautern and Aachen. |
| | May 2019 | BIRS Workshop Oaxaca, Mexico - Flat Surfaces and Dynamics on Moduli Spaces II Program Fudan University Seminar |
| | April 2019 | Geometry and Topology at Brown and Yale (GATSBY) Seminar Pre-talk University of Chicago Dynamics Seminar |
| | December 2018 | California Institute of Technology - Geometry/Topology Seminar |
| | November 2018 | University of Michigan - Geometry Seminar |
| | October 2018 | Yale University - Group Actions and Dynamics Seminar |
| | September 2018 | Yale University - Geometry and Topology Seminar Workshop on Flat Surfaces and Algebraic Curves Mathematisches Forschungsinstitut Oberwolfach |
| | June 2018 | Teichmüller Dynamics, Mapping Class Groups and Applications Institut Fourier, Grenoble |
| | April 2018 | AMS Sectionals - Vanderbilt University Interactions between Geometry, Group Theory and Dynamics Special Section |
| | April 2018 | University of Indiana Bloomington - Bloomington Geometry Workshop |
| | March 2018 | EPSRC Symposium on Geometry, Topology, and Dynamics in Low Dimensions University of Warwick - Teichmüller Dynamics Workshop |
| | August 2017 | The 13th William Rowan Hamilton Geometry and Topology Workshop Trinity College, Dublin - Geometry and Dynamics of Moduli Spaces |
| | May 2017 | Chicago Action Now Dynamics Conference - Northwestern University |
| | May 2016 | BIRS Workshop Oaxaca, Mexico - Flat Surfaces and Dynamics on Moduli Spaces Program |
| | April 2016 | Stanford University - Informal Geometry and Topology Seminar |
| | March 2016 | AMS Sectionals - University of Georgia |
| | March 2016 | University of Utah - Max Dehn Seminar |
| | September 2015 | Indiana University Bloomington - Geometry Seminar |
| | July 2015 | Dynamics and Geometry in Teichmüller Space Conference at CIRM, Luminy |
| | March 2012 | AMS Sectionals - University of Kansas |
| | November 2011 | Conference on Undergraduate Research in Mathematics - Penn State |
| | August 2011 | Young Mathematicians Conference - Ohio State University |

- **Summer@ICERM 2021 REU Organizer (Summer 2021).** Along with Diana Davis and Samuel Lelièvre organized an REU focusing on computational aspects of flat surfaces.
- **University of Michigan REU Organizer (Summer 2020).** Along with Chaya Norton, Alex Wright, and Becca Winarski, ran an REU program for three students on Teichmüller dynamics and flat surfaces.
- **Cornell University REU Project Leader (Summer 2013).** Along with Keith Dennis, directed an REU project for six students on finite group theory.
- **Laboratory of Geometry Winter 2021 Project Organizer (Winter 2021).** Along with Chaya Norton mentored a team of four undergraduates in conducting research on a computational question in the study of flat surfaces.
- **Assn. of Women in Mathematics Symposium Speaker (February 2017).** Delivered a talk for a general audience on the work of Marina Ratner and Maryam Mirzakhani. The goal of the symposium was to increase awareness of the work of women in mathematics and to increase the participation of women in mathematics.
- **Math Circles (Fall 2020).** Led a Math Circles, an enrichment activity for middle and high school students, on planar graphs and Euler characteristic.
- **Directed Reading Program Mentor (Spring 2014, Winter - Spring 2015; Fall 2017 - Spring 2018).** Met weekly with undergraduates and designed reading programs and problem sets for them to assist them in studying advanced topics of their choosing.
- **Univ. of Michigan Postdoc-Grad Mentoring Program (Fall 2020).** Participated as a mentor in a program that pairs postdoctoral researchers with graduate students. Mentored two graduate students.
- **Univ. of Chicago Big Sibling Mentoring Program (Winter 2017-Spring 2017).** Participated as a mentor in a program that pairs upper-year students with lower-year ones. Simultaneously participated in a pilot student teaching program where younger students are allowed to observe, and ultimately teach, classes of older graduate students.
- **Problem Session Leader - Graduate Workshop on Moduli of Curves - Stony Brook (July 2014).** Led problem sessions to complement Alex Wright's lecture series on Teichmüller dynamics.
- **Univ. of Chicago Mathematics Department Warm-up Program Organizer (Fall 2014).** Along with another graduate student, organized two weeks of courses, research talks, graduate student life seminars, and recreational activities for incoming graduate students.
- **Univ. of Chicago Mathematics Department Prospective Student Visitation Organizer (Spring 2014).** Along with another graduate student helped to organize events and housing for visiting prospective students.

TEACHING

Course Instructor at Yale University

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| Spring 2020 | Introduction to Algebraic Topology 2 (Graduate) <i>This course covered vector bundles, K-theory, and the Atiyah-Singer Index theorem.</i> | Math 545b |
| Fall 2019 | Introduction to Algebraic Topology 1 (Graduate) <i>This course prepared PhD students for a qualifying exam on homotopy, homology, and cohomology.</i> | Math 544a |

Course Instructor at the University of Chicago

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| 2016 - 2017 | Calculus | Math 151 - 153 |
| 2015 - 2016 | Calculus, Multivariable Calculus, Linear Algebra | Math 153, Math 196-196 |

College Fellow at the University of Chicago - Led problem sessions and taught several classes.

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| Spring 2014 | Partial Differential Equations | <i>Instructor:</i> Luis Silvestre |
| Winter 2014 | Functional Analysis | <i>Instructor:</i> Panagiotis Souganidis |
| Fall 2013 | Complex Analysis | <i>Instructor:</i> Sidney Webster |

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| SEMINARS | All seminars met weekly. | |
| (CO)-ORGANIZED | Fall 2019 - Spring 2020 | Yale Geometry & Topology Seminar |
| | Fall 2018 - Spring 2019 | Mirzakhani's Thesis |
| | Fall 2015 | Abelian Varieties (AV Club) - Graduate student reading group |
| | Fall 2014 - Spring 2015 | Hodge Theory - Graduate student reading group |
| | Fall 2013 - Spring 2014 | Rigidity in Dynamics - Graduate student reading group |
| | Spring 2013 | Complex Geometry - Graduate student reading group |
| COMPUTATIONAL WORK EXPERIENCE | The Ohio State University: Plasmonics Research Lab (Summer 2009). | |
| | Used a modified version of principal component analysis to analyze the spectra of molecules embedded in nickel mesh. Implemented algorithms in MATLAB. (<i>Mentor: James Coe</i>) | |
| | Wright Patterson AFB: Automated Target Recognition (Summers 2006 and 2007). | |
| | Created algorithms to track and identify vehicles on low resolution video using Kalman filtering. Implemented algorithms in C++ and MATLAB. (<i>Mentor: Andrew Rice</i>) | |
| TECHNICAL SKILLS | Language: Ability to read mathematics in Spanish, French, and Russian | |
| | Computer Language Skills: SageMath, GAP, MAGMA, MATLAB | |