

Keeley Peter Hoek

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Education

- 2020–2025** **Harvard University**
PhD in Mathematics, graduating May 2025.
Advisor: Denis Auroux, Thesis: A Morse-theoretic approach to family Floer homology
- 2016–2019** **Australian National University**
PhB (Honours) (First Class) in Mathematics
with University Medal and ANU National University Scholarship.
Advisor: Kim Morrison, Thesis: Drinfeld centers for bimodule categories

Publications and Preprints

- [1] Keeley Hoek. A Morse-theoretic approach to family Floer homology. *In preparation*.

Previous work

- [2] Ryan Ahern, Mathew Zuparic, Alexander Kalloniatis, and Keeley Hoek. Unifying warfighting functions in mathematical modelling: combat, manoeuvre, and C2. *Journal of the Operational Research Society*, 73(9):2009–2027, 2021.
- [3] Alexander C. Kalloniatis, Keeley Hoek, Mathew Zuparic, and Markus Brede. Optimising structure in a networked Lanchester model for fires and manoeuvre in warfare. *Journal of the Operational Research Society*, 72(8):1863–1878, 2020.
- [4] Richard Taylor, Alexander C. Kalloniatis, and Keeley Hoek. Organisational hierarchy constructions with easy Kuramoto synchronisation. *Journal of Physics A: Mathematical and Theoretical*, 53:085701, 2020.
- [5] Mathew Zuparic and Keeley Hoek. Green’s functions and the Cauchy problem of the Burgers hierarchy and forced Burgers equation. *Communications in Nonlinear Science and Numerical Simulation*, 73:275–290, 2019.

Awards and Honours

- 2022** Harvard University Certificate of Distinction in Teaching
- 2019** ANU University Medal
Hanna Neumann Prize for Mathematics Honours
- 2016–2018** ANU Chancellor’s Letters of Commendation, Dean’s Science Education Commendation
- 2018** Simon Marais Mathematics Competition top 6 pair contestant in Australia
- 2017** Hanna Neumann Prize for Third Year Mathematics
Defence Science and Technology Group Summer Vacation Scholarship
- 2016** ANU National University Scholarship
- 2015** Maximum possible Australian university entrance score, ATAR 99.95 (dux)
Honourable Mention at 16th Asian Physics Olympiad in Hangzhou, China
Top 15 World Finalist in the Breakthrough Junior Challenge
Beth Heyde Award for Academic Excellence

Selected Talks

- Oct 2024** *Family Floer theory via Morse theoretic technology* at the MIT Symplectic Seminar
- Apr 2024** *The Morse A_∞ -category* at the Harvard Zygotop Seminar
- Apr 2023** *A classical uncertainty principle* at the Harvard Trivial Notions Seminar
- May 2022** *Categorical linear algebra* at the Harvard Trivial Notions Seminar
- Oct 2021** *The quantum Toda lattice and introduction to Whittaker functions* at the Harvard Universal Centralizers Seminar

Undergraduate (Australian National University)

- Nov 2019** *Rewrite heuristics and pair exploration for automated theorem proving*
- Jun 2019** *Transfers and tom Dieck splitting via the Wirthmüller isomorphism*
- Nov 2018** *Monoidal ∞ -categories over ∞ -operads: Elements of Higher Algebra*
- Jun 2018** *Why study algebras over functors? Algebras, Monads, and Beck's monadicity theorem*

Teaching Experience

Harvard University

- Spring 2024** Math 157: *Mathematics in the World* (Guest Lecturer)
- Fall 2023** Math 21B: *Linear Algebra and Differential Equations* (TF)
Math 230A: *Differential Geometry* (TA)
- Spring 2023** Math 161: *Introduction to formal verification of mathematics* (Guest Lecturer)
- Fall 2022** Math 21B: *Linear Algebra and Differential Equations* (TF)
Math 230A: *Differential Geometry* (TA)
- Summer 2022** Math 99R: *K-Theory and Hopf invariant one* (Lecturer)
- Spring 2022** Math 21B: *Linear Algebra and Differential Equations* (Coach)
Math 212A: *Advanced Real Analysis* (TA)

Australian National University

- Sem. 1 2020** MATH1115: *Advanced Mathematics and Applications 1* (TF)
- Sem. 2 2019** MATH1116: *Advanced Mathematics and Applications 2* (TF)
- Sem. 1 2019** MATH3349: *Automated Theorem Proving in Lean* (TA)
MATH1115: *Advanced Mathematics and Applications 1* (TF)
- Sem. 2 2018** MATH1116: *Advanced Mathematics and Applications 2* (TF)
- Sem. 1 2018** MATH1115: *Advanced Mathematics and Applications 1* (TF)
- Sem. 2 2017** MATH1116: *Advanced Mathematics and Applications 2* (CA)
- Sem. 1 2017** MATH1115: *Advanced Mathematics and Applications 1* (CA)

Leadership and Service

- 2024** Small group leader for Harvard Math Includes program
- 2021–present** Mentored 7 students (thus far) for Harvard Directed Reading Program (DRP), program organizer since 2022
- 2022–2023** Trivial Notions graduate student seminar co-organizer
- 2017–2020** Volunteered as enricher delivering sessions to high school students for Australian Mathematics Trust Canberra Mathematics Enrichment Programme
- 2017–2020** Volunteered as tutor/senior tutor for Australian Physics Olympiad Summer Schools, subsequent training camps, twice accompanying international team overseas
- 2019–2020** Volunteered to grade local submissions for the Tournament of Towns math competition
- 2016–present** Numerous contributions to open source software, in wide ranging fields from the wgpu graphics library, to GNU Bash, to the Lean interactive theorem prover standard library and tooling

Last updated: September 2024