CATHERINE RAY

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EDUCATION

2017-Present **Northwestern;** PhD Student in Maths

2015-2017 **UChicago;** Divisional Masters Program in Maths; advised by Peter May

2012-2013 **George Mason University;** B.S. in Computational Physics (graduated winter 2013); advised by Dimitrios Papaconstantopoulos

2010-2012 **Mary Baldwin College:** Program for the Exceptionally Gifted: Mathematics, Computer Science, and Physics; advised by John Ong

MENTORSHIP AND COMMUNITY SERVICE

2021-Present **Math Buddy Program**; Helped start a program pairing first and second year graduate students with older graduate students to meet once a quarter for mental health checkups.

2021-Present **TGS Diversity Peer Mentorship Program (Mentor)**; A program where diverse upper year graduate students help first-year diverse PhD students acclimate to Northwestern, providing regular check ins, encouragement and support.

2020-Present **Directed Reading Program Mentor**; One-on-one weekly meetings with an undergraduate to help them learn a topic of their choice, which ends with a presentation of the topic to their peers.

2017-Present **Building Cities with Young Girls**; An weekly informal program building forts and cityscapes with elementary and middle school girls to help local single moms and moms in academia

2020-2021 **Animal Shelter Volunteer**; Fostered special needs adult cats and raised neonatal kittens for Evanston Animal Shelter

2016-2017 **Math Circles Teacher**; Weekly volunteering to teach math to kids 6-12 in the South Side of Chicago

2015-2017 **Research Experience for Undergrads Mentor**; Summer program with weekly lecture and interaction, as well as guiding each undergrad on a targeted individual research program.

FELLOWSHIPS

2017-Present	**NSF Graduate Research Fellowship**
2014-2016	**Thiel Fellowship (100K)**

PUBLISHED PAPERS

Dec 2019	**Automorphisms of Abelian Varieties and Principal Polarizations** – joint with D. Lee arXiv:1811.07007 (published Rend. Circ. Mat. Palermo, II. Ser (2021))
Feb 2019	**Towards Directed Collapsibility** – joint with R. Belton, R. Brooks, S. Ebli, L. Fajstrup, B. T. Fasy, N. Sanderson, E. Vidaurre arXiv:1902.01039 (published in Advances in Mathematics: AWM Springer 2018 Symposium)

PREPRINTS/IN PREPARATAION

Nov 2019	**A Global Crystalline Period Map** – joint with M. Neaton and A. Pieper Nov 2019 – arXiv:1911.08615 (collaboration from 2019 Arizona Winter School)
In Preparation	**A Geometric Model of Higher K-theories at Height h=p^{k-1}(p-1) via Families of Ramified Curves** – (my thesis in progress)

SEMINARS ORGANIZED

2022 Winter	**Stop Staring and Compute!** (Methods of Computation in Number Theory and Homotopy Theory)
2020 Winter	**Moduli Spaces** (Algebraic and Analytic talks alternating every other week)
2019 Spring	**Applications of Topos Theory** (Homotopy Working Seminar)
2019 Winter	**TamagaWHAT** (On the Proof of the Tamagawa Conjecture for Function Fields)
2019 Winter	**Formal Moduli Problems** (Homotopy Working Seminar)

2018 Fall	**Geometry for Prime Addicts** (p-adic geometry toward Scholze's proof of the Monodromy Weight Conjecture)
2018 Fall	**Factorization Homology** (Homotopy Working Seminar)

RECENT INVITED TALKS

Galois Theory of Spheres, Front Range Number Theory - 2021

Explicit arithmetic of Jacobians, ICERM Workshop on Arithmetic Geometry, Number Theory, and Computation - 2020

Inverse Galois Theory in the Homotopy Groups of Spheres, Princeton CCR Colloquium - 2019

Galois Theory and Galois Representations in Homotopy Theory, Higher School of Economics, Moscow - 2019

An Introduction to the Classic Theory of p-Divisible Groups, Oberwolfach Arbeitsgemeinschaft - 2019

ATTENDED CONFERENCES

ICERM Workshop on Arithmetic Geometry, Number Theory, and Computation - 2020

Arizona Winter School: Nonabelian Chabauty (Fundamental Groups of Curves) - 2020

Lunts' Dacha: Representations of Algebraic Groups: constructible, coherent, and categorical viewpoints, Grigorovska, Russia – 2019

AMS MRC: Explicit Arithmetic Geometry in Characteristic p, Rhode Island – 2019

Arbeitsgemeinschaft: Elliptic Cohomology According to Lurie, Oberwolfach – 2019

Arizona Winter School: Homotopy Theory and Arithmetic (Hopkins Project Group) - 2019

Homotopy Theory and Arithmetic Geometry: Motivic and Diophantine Aspects, London, UK – 2018

Chromatic Homotopy Theory, Journey to the Frontier, Boulder, Colorado – 2018

Midwest Topology Seminar, Northwestern – 2018

Women In Topology Workshop at MSRI, Berkeley -- 2017

2017 Talbot: Obstruction theory for Structured Ring Spectra, Boise, Idaho – 2017

Midwest Topology Seminar, UChicago – 2017

Conference on invertible objects and duality in derived algebraic geometry and homotopy theory, Regensburg, Germany – 2017

European 2016 Autumn School in Topology, Utrecht, Netherlands – 2016

Homotopy Theory and Number Theory: WCATSS, Eugene, Oregon – 2016

Young Topologists Meeting, Copenhagen – 2016

2016 Talbot: Kervaire Invariant One problem, Salt Lake City, Utah – 2016

Midwest Topology Seminar, Wayne State – 2016

Midwest Topology Seminar, Northwestern – 2016
Midwest Topology Seminar, UChicago – 2015
p-adic methods in Number Theory, Berkeley – 2015
Homotopy theory, manifolds, and field theories, Bonn, Germany – 2015
Introduction to Geometric Langlands, MSRI – 2014

PUBLICATIONS/TITLES OF CREATIVE WORK OUTSIDE OF MATH

2015 **Simplifying Multiscale Modeling,** Santa Fe Insitute of Complex Systems

2014 **A New Female-Female Mouse Vocalization Discovered via Unlabeled Machine Learning,** Mousera

2014 **On the Detection and Prevention of Aggression in Lab Mice via Quasi-Real Time Analysis,** Mousera

2013 **Contextual Machine Learning through the Analysis and Chunking of Partially Translated Grade 2 Braille,** George Mason Computational Semantics

OTHER EXPERIENCE

2014-2016 **2014 Thiel Fellow (Mathematics and Assitive Tech)**; Thiel Foundation; Berkeley, CA

2015 **Visiting Researcher**; Max-Planck-Institut für Mathematik; Bonn, Germany

2015 **Visiting Researcher**; Santa Fe Institute of Complex Systems; Santa Fe, NM

2013-2014 **Mouse Vocalization Specialist & Audio Processing Engineer**; Mousera; Belmont, CA

2013 **Software Engineering Intern**; Cloudera; Palo Alto, CA

2013 **Computational Chemistry Research;** George Mason University, VA

2013 **Automated Computational Semantics (& Machine Learning) Research**; George Mason University; Fairfax, VA

2012 **Human-Computer Interaction Intern (Autonomous Robotics)**;
George Washington University; Washington D.C.

2012 **Teaching Assistant for College Algebra**; Mary Baldwin College

2011 **Research Assistant in Materials Science Lab;** Mary Baldwin College;
Staunton, VA

NONPROVISIONAL PATENT APPLICATION

2013 **Robotic Mobility Assistive Wheelchairs,** 90776.0001USP1

UNDERGRAD AWARDS AND HONORS

2013 **Outstanding Rising Senior Award** in Computational and Data
Sciences, SPACS 2013

2012-2013 **Dean's List,** George Mason University

2010-2012 **Dean's List,** Mary Baldwin College