Krystal Maughan

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Research Interests: Supersingular Isogeny Cryptography, Mathematical Cryptography

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University of Vermont, PhD candidate ***2019-present***
Computer Science PhD student, minor in Pure Mathematics

RESEARCH EXPERIENCE:

Research Assistant (Vermont) ***2021-2024***
Supervisors: C. Vincent, J. Near: Research on Isogeny Graph Cryptography, Mathematical Cryptography

Research Assistant (Vermont) ***2019-2021***
Supervisor: Joe Near: Research on Provable Fairness and Privacy Using Machine Learning.
Funded via Amazon Research Award (2020-2022 PI: J. Near, D. Darais)

Conference Publications:

- *"Continual Audit of Individual Fairness in Deployed Classifiers via Prediction Sensitivity" (**Maughan, K**, I. Ngong and J. Near) (under review)* — *2021*

Workshop Publications:

- *"Attribute Differential Privacy" **(Pre-print available upon request)** (**Maughan, K.** and Near, J.)* — *2021*
- *"Towards a Measure of Individual Fairness for Deep Learning" (**Maughan, K.** and Near, J.) - presented as poster for **MD4SG 2020*** — *2020*
- *"Towards Audibility for Fairness in Deep Learning" (Ngong, I., **Maughan, K.** and Near, J.)- presented as poster for **AFCI at NeurIPS*** — *2020*
- *"Archipelago Penseé" (**Maughan, K**.) presented artwork and writing as a poster: **RAIS (Resistance AI) at NeurIPS*** — *2020*

Graduate Teacher's Assistant, Fall/Spring 2019-2020 (Vermont) ***2019-2020***
Compiler Construction with Haskell (taught by Joe Near) *2020*
Advanced Web Design (taught by Bob Erickson)
Programming with Matlab (taught by Radhakrishna Dasari) *2019*
Data Privacy with Jupyter, Python (taught by Joe Near)

GRANT WRITING / PROPOSALS

- *COST Action Proposal OC-2021-1-25315 "Mathematics and Algorithmics of Group actions and Isogenies for Cryptography" (Secondary Proposer)* — *2021*
- *Microsoft Research, Reinforcement Learning Open Source Festival Proposal (Awarded $10,000)* — *2021*
- *Meta: Building Tools to Enhance Privacy and Fairness (as co-PI with PI J. Near and PI J. Onaolapo) (not awarded)* — *2021*

GRANT WRITING / PROPOSALS

- *CDS&E Computational and Data-Enabled Science and Engineering Database Grant Proposal for SageMaths (as Key Personnel) (PI B. Hutz, PhD) (not awarded)* — *2020*
- *Google Summer of Code, Proposal to Haskell.org (Awarded $6,000)* — *2018*
- *Helium Grant, (for exploring questions on the edge of mainstream thinking) (Awarded $1000)* — *2018*

MERIT-BASED MENTORSHIPS / RESEARCH MENTORSHIPS

Mentee, Google's CS Research Mentorship Program (CSRMP) with A. Lees, PhD — *2021*
Mentee, AiC Connectors Program with Facebook with O. Dalleleau, PhD — *2021*
Mentee, She256 Blockchain Group with P. Mishra, PhD — *2021*
Mentee, Women in Privacy and Security (WISP), D. Sharma, PhD — *2021*
Mentee, Global Outreach Mentorship with S. Gupta, PhD (EC 2020) — *2020*
Mentee, LatinX in AI Research Workshop Mentorship, C. White, PhD (NeurIPS 2021) — *2021*
Mentee, LatinX in AI Research Workshop Mentorship with J. Barajas, PhD (ICML 2020) — *2020*
Mentee, Mentored by Amal Ahmed, PhD (ICFP 2020) — *2020*
Mentee, Lighthouse3 AI Ethics Mentoring Externship with F. McEvoy (1 of 20 chosen) — *2020*
Mentee, Code2040 Fellowship with Ben Waber, PhD — *2020*

ACADEMIC REVIEWER

Reviewer, Springer AI and Ethics Journal — *2020 - present*
Reviewer, PML4DC (Practical Machine Learning for Developing Countries), ICLR — *2021-2022*
Reviewer, BlackAIR Summer Research Grant Program — *2021*
Reviewer, ICLR Distributed and Private Machine Learning workshop — *2021*
Committee Reviewer, HCI Track, GHC (Grace Hopper Conference) — *2021*
Reviewer, Tapia Conference (Panels and Workshops) — *2021*
Reviewer for AFCR workshop at NeurIPS (Fairness, Accountability, Robustness) — *2021*
Reviewer for AFCI workshop at NeurIPS (Fairness and Accountability) — *2020*
Reviewer for Black in AI at NeurIPS workshop — *2020-2021*
Reviewer and Programme Committee Member, LXAI@ICML Workshop — *2020*
Committee Reviewer, HCI Track, GHC (Grace Hopper Conference) — *2020*
Chair Reviewer, PML4DC (Practical ML for Developing Countries) workshop, ICLR — *2020*
Reviewer, Tapia Conference (Panels and Workshops) — *2020*
Reviewer, Travel Grant Applications, Black in AI for AAAI — *2020*

ACADEMIC JOURNALS (AI/Machine Learning)

Board Member, AI and Ethics, Springer — *2020*

REVIEWER (NON-ACADEMIC PEDAGOGICAL)

Published Book, "Effective Haskell" by R. Skinner — *2022*

RESEARCH PhD INVITATIONS

Virtual Participant, MSRI: Connections Workshop: *2023*
- *Algebraic Cycles, L-Values and Euler Systems*
- *Introductory Workshop: Algebraic Cycles, L-Values and Euler Systems*
- *Shimura Varieties and L-Functions*

Virtual Participant, West Coast Number Theory (WCNT): Problems in Number Theory *2021*
Participant, GREPSEC V: *2021*
- *(Graduate Students in Privacy and Security Early Career Workshop)*

Participant, Isogeny-Based Cryptography Winter School *2021*
Participant, Post-Quantum Networks Workshop *2021*
Participant, PRIMA Summer School *2021*
- *Rational curves and moduli spaces in arithmetic geometry*

Initiative for Cryptocurrencies and Contracts (IC3) Blockchain Bootcamp *2021*
- *Worked on group project : Fairness consensus for Miner Extractable Value (MEVs)*
- *Implemented Aequitas protocol from paper with authors for fairness simulation*
- *One of top four winning teams chosen*

Participant, Scottish Programming Languages and Verification School *2021*
Invited Participant,"Key themes for informing a Research Roadmap", *2021*
The Alan Turing Institute:
- *Invited Participant,"Threats and Opportunities for AI in Cybersecurity"* *2021*
- *Invited Participant,"Society-centric approaches to AI challenges in* *2021*
- *Invited Participant, "Environmental Enables for AI challenges in* *2021*

Participant, Self Organizing Conference on Machine Learning (SOCML) *2021*
- *Machine Learning, and Privacy session, Moderated by U. Erlingsson* *2021*
- *organized by I. Goodfellow (1 of 9 chosen)*

Simons Institute, Average-Case Complexity: From Cryptography to Statistical Learning *2021*
Simons Institute, Optimization Under Symmetry *2021*
Simons Institute, Innovations in Theoretical Computer Science (ITCS) *2021*
Simons Institute, Geometric Methods in Optimization and Sampling Bootcamp *2021*
Participant, Community-Driven Cryptography Seminar (Brown / John Hopkins) *2021*

MERIT-BASED GRANTS / SCHOLARSHIPS

Google Grace Hopper Conference (GHC) Scholarship *2021*
NCWIT Collegiate Award Finalist (1 of 80) *2021*
WISP & Black Hat USA Briefings Scholarship (1 of 25) *2021*
Kernel Fellowship Block III via Gitcoin (Security: Zero Knowledge Proofs project) *2021*
Gitcoin Scholarship for Women (for Kernel Fellowship Block III) *2021*
She256 Mentorship focused on ZK Snarks (6 months) *2021*
USENIX Security Conference 2021 (via USENIX Diversity Grant via GREPSEC V) *2021*
TechX Social Impact / Harvard Franklin Fellowship (1 of 12) *2020*
USENIX Enigma Grant *2021*
NCAS Workshop participant (NASA Community College Aerospace Scholars) *2016*
Who's Who/ Peggy Williams Memorial Scholarship/ Best BFA Award (Best of Major) *2008*

OTHER GRANTS/ FELLOWSHIPS

Upstate Number Theory Conference 2021 (lodging provided) *2021*

OTHER GRANTS/ FELLOWSHIPS

IEEE Symposium on Security and Privacy (student travel grant, complimentary ticket) *2021*
4th Annual ZK-Proof Workshop (complimentary ticket) *2021*
WISP Privacy+Security Conference *2021*
- *EU Data Law / De-Identification Workshop (Scholarship via WISP)*

ICERM (Brown University) Variable Precision in Mathematical & Scientific Thinking *2020*
RWC2020 (Real World Crypto: registration, flight, lodging) Grant via IACR *2020*
Sage-Days-104 : To work on SageMath Software: Arithmetic Dynamics *2019*
Simons Institute (Berkeley) Error-Correcting Codes and High-Dimensional *2019*
Expansion Boot Camp (attendee)
ICERM (Brown University) Encrypted Search Workshop Grant (Lodging provided) *2019*
Cornell Number Theory Conference Grant (Lodging provided) *2019*
MSRI (Mathematical Sciences Research Institute) Grants to attend:
Optimal Transport and applications to machine learning and statistics *2020*
Connections for Women: *2019*
- *Derived Algebraic Geometry, Birational Geometry and Moduli Spaces workshop*
- *Introductory Workshop: Derived Algebraic Geometry and Birational Geometry And Moduli Spaces*

Racket Summer School (National Science Foundation Grant) *2018-2019*
PLMW (Programming Languages Mentorship Workshop) *2018*
ICFP (International Conference Functional Programming)
PLMW(Programming Languages Mentorship Workshop) *2018*
PLDI (Programming Languages Design and Implementation)
OPLSS (Oregon Programming Languages Summer School Grant) - declined offer *2018*

ACADEMIC SERVICE

Panelist, PhD recruiting event (included multiple schools, sponsored by CodePath) *2020*
Student Volunteer, ICFP (International Conference Functional Programming) *2020*
Student volunteer, ICFP (International Conference Functional Programming) *2018*
Student volunteer, PLDI (Programming Languages Design and Implementation) *2018*
Student volunteer, POPL (Principles of Programming Languages) *2018*
Student volunteer, SPLASH *2018*
(Systems, Programming, Languages, and Applications) (declined offer)

INDUSTRY PhD INVITATIONS

Fellow, JP Morgan, Advancing Black Pathways in AI & Quantitative Modelling Program *2022*
Participant, JP Morgan, Advancing Black Pathways in AI & Quant Modeling Summit *2021*
Participant, Facebook, Amplified: Above & Beyond Computer Science Program (PhDs) *2021*
Participant, Facebook's Amplified: Virtual Vivid in Research (1 of 30) *2021*
Participant, Galois 1st Summer School on Trustworthy Machine Learning (1 of 35) *2021*
Participant (via CSRMP), Google PhD Fellowship Summit *2021*
Participant, Jane Street PhD Symposium (New York, remote) (Quant Research) *2021*
Participant, JP Morgan, Advancing Black Pathways in Data Science *2021*
Participant, TwoSigma Mock Interview Day for Early Career Women (Quant Research) *2021*
Participant, Hudson River Trading (HRT) Systems Engineering Tech Talks (1 of 14) *2021*
Participant, Adobe, "The Future of Creativity" (Virtual) *2020*

INDUSTRY PhD INVITATIONS

Participant, Microsoft Research, Frontiers in Machine Learning (Redmond, remote) *2020*
Participant, Discover Bloomberg: Women in Engineering event (New York, remote) *2020*
Participant, Twitter PhD ML Flock Event (New York, Boston office) *2019*

GRADUATE SCHOOL INTERNSHIPS

JP Morgan, *Quantitative AI Research, Summer 2022 (New York) (1 of 10)* *2022*
Microsoft Research*, Independent Contractor, Summer 2021 (New York: remote)* *2021*
Microsoft, *PhD Intern, Summer 2021 (Redmond: remote)* *2021*
Autodesk, *PhD Intern, Summer 2020 (Pier 9, San Francisco: remote)* *2020*

RELEVANT WORK / INDUSTRY EXPERIENCE

Mercury Banking (Haskell fintech) : *Software Engineering Intern (San Francisco)* *2019*
Apple, Inc.: *Software Engineering Intern (Sunnyvale)* *2019*
Google Summer of Code: *Developer for Haskell.org (remote)* *2018*
Mozilla: *Increasing Rust's Reach Developer (remote)* *2018*

NON-ACADEMIC SERVICE

Invited Finalist Judge, Technovation, AI for Good *2021*
Participant, Git Contributors Inclusion Summit *2020*
Reviewer, Code2040 Application Essays *2020*
Reviewer, OpenMined Differential Privacy articles *2020*
Judge, DataKind, Data.org, Inclusive Growth and Recovery Challenge *2020*
Google Developer Student Club Lead (for University of Vermont) *2019*
Reviewer, Travel Grant Applications, Clojure Conj (2 rounds) 2017

OTHER (NON-INDUSTRY) TALKS

Brown University, Fair February talk on Security, Privacy, Fairness *2022*
"Composable Forgetful Isogeny Graph Cryptography", Google CSRMP Research *2021*
"Isogeny Graph Cryptography", School for Poetic Computation, Re-learning to love Maths 2021
"Isogeny Graph Cryptography", School for Poetic Computation,"Learning to Love Maths" 2021
Invited Panelist, Peer-connected Undergraduate Research Exploration in Computer and Information Science and Engineering (PRE.CISE) *2021*
University of Vermont, CIS196, Privacy Law Research Talk *2021*
PLAID Lab speaker, "What Scientists can learn from Artists" *2020*
PLAID Lab Speaker, "Information Theory: from Spacecraft to Blockchain" *2021*
CS Crew Project talk : contributing to Maths software (CodeWorld, SageMaths) *2019*

CLASSES (PhD)

Doctoral Research with advisors Joe Near and Christelle Vincent *2021-present*
Abstract Algebra IV A: (Ring and Module Theory) taught by Taylor Dupuy (Spring) *2022*
Abstract Algebra IV C: (Elliptic Curves & Modular Forms), taught by Christelle Vincent *2022*
Random Probabilistic Graphs, taught by Puck Rombach *2022*
Abstract Algebra I taught by Puck Rombach (Commutative Group theory) (Fall) *2021*
Abstract Algebra III taught by Christelle Vincent : (Fields, Rings, Galois Theory) (Fall) *2021*
(Post-quantum) Mathematical Cryptography, taught by Christelle Vincent (Spring) *2021*

CLASSES (PhD)

Privacy, Law and Policy, taught by Ryan Kriger (Spring) *2021*
Secure Distributed Computation; taught by Joe Near using Python (Fall) *2020*
Machine Learning; taught by Safwan Wshah using Python (Spring) *2020*
Doctoral Research with advisors Joe Near and David Darais (Spring, Fall) *2019-2020*
Data Privacy; taught by Joe Near using Python (Fall) *2019*
Software Verification; taught by David Darais using Agda (Fall) *2019*
Computer Human Interaction; taught by Josh Bongard (Fall) *2019*

CLASSES (AUDIT)

UVM: Elementary Number Theory taught by Christelle Vincent (Spring) *2022*

Stanford EE 374 : Internet-Scale Consensus in the Blockchain Era *2021*

- *Information Theory class focused on scalability and protocols in Blockchain*
- *Taught by D. Tse, PhD through Stanford University*
- *Audited class, scribed for Lecture 11, Spring 2021*

CLASSES (RELATED)

Rewriting the Code (RTC) Blockchain Basics + Developer Workshop *2021*

HACKATHONS

R Data Hackathon 2021, First Place, "Cast and Gender Roles in Movie Data" *2021*

- *Our group won First place at the R Data Hackathon 2021 for Best Visualization*

Initiative for Cryptocurrencies and Contracts (IC3) Blockchain Bootcamp *2021*

- *Worked on group project : Fairness consensus for Miner Extractable Value (MEVs)*
- *Implemented Aequitas protocol from paper with authors for fairness simulation*
- *One of top four winning teams chosen*

Skills: Python, Haskell, Matlab, Sage, (learning Rust and R), LaTeX, Jupyter, SQL, AWS, PySpark, Sparklyr, Maplesoft, Tensorflow, Git

ACADEMIC ASSOCIATION FOR COMPUTING MACHINERY (ACM) MEMBERSHIPS

Student Member, International Association of Cryptologic Research (IACR) *2020-present*
SIGecom Special Interest Group on Economics and Computation *2020-2021*

NON-ACADEMIC MEMBERSHIP

Member, Women in Number Theory *2018-present*
Member, QVNTS (Quebec-Vermont Number Theory Seminar) *2021-present*
Member, Women in Combinatorics *2021-present*
Member, Association for Women in Mathematics *2021-present*
Member, She256 *2021-present*
Member, Women in Security and Privacy (WISP) *2020-present*