\mathbf{C} URRICULUM \mathbf{V} ITAE

 \mathbf{M} Ahrud \mathbf{S} Ayrafi

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| EDUC. | ATION | | | | | |
|-------|--|---|---|--------------------------------|--|--|
| 2018 | - 2024 | University of Minnesota, Twin Cities Expected Graduation: May 2024 | Ph.D. Candidate in M ADVISOR: Christine Be | athematics erkesch | | |
| 2014 | -2017 | University of California, Berkeley | B.A. with Honors in M | Inthematics | | |
| AWAR | DS | THESIS: Local Computations in Macaulay2 | ADVISOR: David Elsen | bud | | |
| 2023 | - 2024 | Doctoral Dissertation Fellowship, University of | Minnesota | | | |
| 2020 | | Honorable Mention, Graduate Research Fellows | hips Program, NSF | | | |
| 2018 | - 2020 | John Ordway Fellowship, School of Mathematic | s, University of Minneso | ota | | |
| GRAN | TS | | | | | |
| 2023 | NSF Workshop Grant DMS-2302476 for M2Week Co-PI and organizer for the Macaulay2 Workshop & Mini-school in Minneapolis, MN. | | | | | |
| 2022 | NSF Workshop Grant DMS-2206872 for GradMoCCA Co-PI and organizer for the Graduate Meeting on Combinatorial Commutative Algebra. | | | | | |
| 2018 | 18 Seed Grant, DRP Network Awarded to the Directed Reading Program (see service section) for purchasing books. | | | | | |
| PUBLI | CATIC | DNS AND $\mathbf{P}_{\text{REPRINTS}}$ | | | | |
| 2022 | 5. "A M 4. "B | A short resolution of diagonal for smooth projective. K. Brown. To appear in Algebra & Number The Bounds on multigraded regularity? | re toric varieties of Pica: eory. | rd rank 2" arXiv:2208.00562 | | |
| | 4. L J. | Bruce, and L. Cranton Heller. Submitted. | | arXiv:2208.11115 | | |
| 2021 | 3. "C J. | Characterizing multigraded regularity on products Bruce, and L. Cranton Heller. Submitted. | of projective spaces" | arXiv:2110.10705 | | |
| 2020 | "The virtual resolutions package for Macaulay2" A. Almousa, J. Bruce, and M. C. Loper, J. of Software for Algebra & Geometry 10 (2020), 51–60. | | | | | |
| 2017 | 17 1. "What is the optimal way to prepare a Bell state using measurement and feedback?" L. Martin and K. B. Whaley. <i>Quantum Sci. & Technol.</i> 2 (2017), no. 4. | | | | | |
| INVIT | ED \mathbf{T}_{A} | ALKS (selected) | | | | |
| | erence | S Joint Moth Mostings in Son Evansians | | | | |
| 2024 | Jan. Oct | Jan. Joint Math Meetings in San Francisco Oct – Fall Control AMS Sectional Meeting, Creighton University, Omaha | | | | |
| 2020 | Jul. | SIAM Applied Algebraic Geometry Conference. F | Eindhoven University, th | e Netherlands | | |
| | Jul. Géométrie Algébrique en Liberté, University of Warwick, UK | | | | | |
| | Apr. | CA+ Conference, University of Minnesota, Twin | Cities | | | |
| | Mar. | Spring Southeastern AMS Sectional Meeting, Geo | orgia Tech, Atlanta | | | |
| 2022 | Oct. | Fall Western AMS Sectional Meeting, University | of Utah, Salt Lake City | | | |
| 0001 | Sep. | Fall Central AMS Sectional Meeting, University of | of Texas, El Paso | | | |
| 2021 | Apr. | Spring Central AMS Sectional Meeting, Universit | y of Cincinnati (virtual |) | | |
| Semi | nars | In the of Maharaha I in a la Commutation A | 1 | | | |
| 2023 | Apr. Fob | Tayas Alim University Algebra and Combinator | ligebra Seminar | | | |
| 2022 | Oct | University of Utah Algebraic Geometry Seminar | its Seminar | | | |
| 2022 | Oct. | Arizona State University, Number Theory and Al | gebra Seminar | | | |
| 2021 | Oct. | Auburn University, Algebra Seminar | 0 | | | |
| | Feb. | ICERM semester in Combinatorial Algebraic Geo | ometry, Grad/Postdoc S | leminar (virtual) | | |
| Poste | ers | | | | | |
| 2023 | Nov. | Western Algebraic Geometry Symposium, Washin | ngton University in St. I | Louis | | |
| 2022 | May Jun. | MSRI/SLMath Summer School in Commutative . Pan-American School in Commutative Algebra, G | Algebra, University of N CIMAT, Mexico | lotre Dame | | |
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TEACHING and MENTORING EXPERIENCE

| School of Mathematics, University of Minnesota, Twin Cities2023 SpringMATH 1272: instructor of record for Calculus II (class of approx. 100 students).2022 FallMATH 8253: graded homework for Algebraic Geometry (graduate course).2022 SpringMATH 1272: instructor of record for Calculus II (class of approx. 90 students).2019 - 2021MATH 2243: TA for Linear Algebra & Differential Equations (six sections total).2018 FallMATH 1271: TA for Calculus I (two sections total). | | | | | | |
|--|--|--|--|--|--|--|
| 2020 SummerREU: mentored P. Cranford, A. Peng, and V. Srinivasan towards arXiv:2106.12667.2019 & 2022DRP: mentored five undergraduate students in weekly reading projects. | | | | | | |
| Departmentof Mathematics, UC Berkeley2015 SpringMath113: graded homework for Abstract Algebra.2014 FallMath116: graded homework and assisted the instructor for Mathematical Cryptography. | | | | | | |
| Math Center, Irvine Valley College2013 – 2014Tutored lower-div courses including linear algebra, differential equations, and discrete math. | | | | | | |
| Mathobotix, Irvine, CA 2012 – 2014 Developed curriculum for computer science-based problem-solving using Python. | | | | | | |
| CONFERENCE AND WORKSHOP ORGANIZATION 2023 Jun. Macaulay2 Workshop & Mini-school Weeklong event in computational commutative algebra bringing about 70 researchers to Minneapolis. 2022 May Graduate Meeting on Combinatorial Commutative Algebra Weekend graduate event with 12 speakers bringing about 70 students and postdocs to Minneapolis. | | | | | | |
| MATHEMATICAL SERVICE | | | | | | |
| 2018 - 2023 Directed Reading Program, University of Minnesota, Co-founder and co-organizer Matched over 250 undergraduate and graduate students in guided mathematics reading projects. 2019 - 2022 Student Commutative Algebra Meeting, University of Minnesota, Co-organizer Held a weekly meetup of friendly neighborhood commutative algebra students. 2021 Apr. Graduate Student Combinatorics Conference, Session Chair Chaired the session on Combinatorial Algebraic Geometry. 2017 - 2018 Pauline Sperry Undergraduate Lecture Series, UC Berkeley, Organizer Inaugurated an annual lecture aimed at providing a role model for marginalized students in math. | | | | | | |
| Referee Work: Journal of Software for Algebra and Geometry, Journal of Pure and Applied Algebra | | | | | | |
| BROADER OUTREACH | | | | | | |
| 2019 - 2023 Vincent Hall Thespians, University of Minnesota, Performer Helped with first-time teaching assistant orientation through situational comedy. 2023 Jan. Minnesota Project in Mathematics, Counselor | | | | | | |

Helped with workshops and mentored two undergraduate projects during the week-long program. 2019 – 2020 AMS Graduate Student Blog, Staff Writer

- Wrote about finding community through mathematical art and history.
- 2018 Jul. Girls Who Code @ Cloudflare, Workshop Leader
- Instilled an appreciation for mathematics in high school girls using elliptic cryptography puzzles. 2016 – 2017 Mathematics Undergraduate Student Association, UC Berkeley, President Helped build an inclusive and diverse community among undergraduate math students at Berkeley.
- 2014 & 2015 Berkeley mini Math Tournament, Grader and Lecturer Instilled an appreciation for knot theory in advanced elementary and middle school students.

OTHER WORK **E**XPERIENCE

2020 & 2022 Fall Mathematical Sciences Research Institute, Macaulay2 Developer (see below)

2018 Summer Cloudflare, Inc. Cryptography Engineering Intern

Launched multiple products involving Tor, Keyless SSL, and distributed randomness generation.

2017 Winter **Proton Research, Inc.** Cryptography Research and Development Intern Added support for elliptic curve cryptography in OpenPGP.js.

WORKSHOPS and SUMMER SCHOOLS (selected)

- 2023 Sep. Syzygies and mirror symmetry, American Institute of Mathematics, Pasadena, California Topics: resolutions of the diagonal for toric varieties, homological mirror symmetry
 - Jul. Géométrie Algébrique en Liberté, University of Warwick, UK Topics: Mori Dream Spaces and quiver GIT, klt singularities, the geometry of curves
 - Jun. MRC Derived Categories, Arithmetic and Geometry, AMS Topics: Frobenius pushforwards and F-thickness of the blowup $Bl_5 \mathbf{P}^2$
 - May **MSRI/SLMath Summer School in Commutative Algebra**, University of Notre Dame TA for mini-course on the geometry of nonstandard syzygies by Daniel Erman
- 2022 Dec. **RTG Workshop on Birational Complexity**, SCGP, Stony Brook University Topics: rationality, curves in algebraic varieties, the Cremona group, measures of irrationality
 - Jun. **Pan-American School in Commutative Algebra**, CIMAT, Mexico Topics: positive characteristic methods, toric varieties, DG algebras, modules of differentials
- 2021 Spr. **Combinatorial Algebraic Geometry**, ICERM Topics: Schubert varieties, toric varieties, tropical varieties, cluster algebras and varieties
- 2018 May **RTG Summer School in Commutative Algebra**, University of Utah Topics: limits in positive characteristic, symbolic powers, differential operators, and syzygies.

Mar. Geometry of Redistricting Workshop, University of San Francisco Topics: gerrymandering, voting rights, discrete geometry and graph theory

OPEN SOURCE DEVELOPMENT

Since 2017 Macaulay2 Internals

- I have contributed to various internal components of Macaulay2, including the engine, interpreter, core mathematical routines, and documentation. I have also contributed to the following packages:
- Since 2020 **NormalToricVarieties**: added support for pullbacks of coherent sheaves over toric maps, and computations on the Cox ring of toric varieties whose class group has torsion.
- Since 2021 **Truncations**: added support for truncations of modules with respect to arbitrary cones, for instance on simplicial toric varieties where the nef and effective cones differ.
- Since 2020 **Saturation**: improved and added to core routines for computing annihilators, saturations, and quotients of ideals and modules, with J. Chen and M. Stillman.
- Since 2019 FGLM: for computing Gröbner bases of zero-dimensional ideals, with D. Peifer.
- Since 2018 VirtualResolutions: see paper above, with A. Almousa, J. Bruce, and M. Loper.
- Since 2017 LocalRings: for symbolic computations over local rings, with M. Stillman.

PROFESSIONAL

Memberships:

AMS, SIAM Activity Group on Algebraic Geometry.

Programming:

Proficient in Macaulay2, C/C++, Python, and Node.js. Experienced in Go, Rust, SageMath, and IDL. Familiar with Julia, Mathematica, MATLAB, and Haskell.

OTHER RESEARCH EXPERIENCE

2017 Summer Institute for Quantum Computing, University of Waterloo Topics: quantum error correcting codes from algebraic curves under John Watrous.

2015 – 2016 Berkeley Quantum Information and Computation Center, UC Berkeley

Topics: control theory & entanglement generation under Leigh Martin and Birgitta Whaley. 2014 Summer Institute for Quantum Information and Matter, Caltech

Topics: quantum game theory and semi-definite optimization under Thomas Vidick. 2013 Summer Jet Propulsion Laboratory, NASA

Topics: secure multiparty computation and secret sharing systems under Ed Chow.

\mathbf{R} EFERENCES

| Christine Berkesch | David Eisenbud | Daniel Erman | Craig Westerland |
|--------------------|-----------------|------------------|------------------|
| cberkesc@umn.edu | de@berkeley.edu | erman@hawaii.edu | cwesterl@umn.edu |
| Advisor | | | Teaching |