Julia Marie Shapiro

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RESEARCH INTERESTS

Adversarial network coding, quantum computing, algebraic geometric codes, post- quantum cryptosystems

EDUCATION

- **M. S. in Mathematics,** Virginia Tech, U.S.A., anticipated May 2024
  Advisor: Prof. Gretchen Matthews
  Prospective Ph.D. to be completed in 2027
  VT Mathematics Graduate Ambassador

- **B. S. in Mathematics,** University at Buffalo Honors College, U.S.A., May 2022
  GPA: 3.951
  Major GPA: 3.98

PROFESSIONAL EXPERIENCES

- **Mathematics Department Senator on the Graduate Professional and Student Senate (GPSS)**
  Responsibilities included attending committee meetings and representing the Mathematics Department.

- **Founder and Organizer of the VT Graduate Student Seminar**
  organized jointly with A. Miller (VT)
  January 2024-Present
  The VT Graduate Student Seminar is a twice monthly seminar for graduate students only. Graduate students have the opportunity to present works in progress and practice for upcoming conference presentations.

- **Organizer of PICS: Postgraduate International Coding Theory Seminar**
  organized jointly with G. Cotardo (VT), A. Gruica and B. Jany (Eindhoven University of Technology)
  January 2024-Present
  PICS is a twice monthly online seminar for PhD students and early-stage postdocs

- **Graduate Research Assistant,** Virginia Tech Hume Center for National Security and Technology
  August 2022-Present
  Quantum approaches to solving the NP hard **Quadratic Assignment Problem**, joint work with the Naval Engineering Education Consortium (NEEC).

- **Chair of Hot Topics in the Science of Security (HotSoS),** Mentorship/Publicity Chair
  August 2022-Present
  chaired jointly with A. Tagert (NSA), R. Gabrys (Naval Information War Center), N. Ajmeri (University

of Bristol), M. Sarkarvadia (University of Chicago) for 2023 and 2024 conferences

- **National Security Agency,** Cybersecurity Intern
  May 2023-August 2023
  Gained experience using the functional program called Cryptol.
  Learned how to implement different NIST specifications such as NTRU.
  Used SAT and SMT solvers to check algorithm equivalences in hopes of improving these algorithms and enhancing Department of Defense standard software and systems development processes.

- **National Security Agency,** Mathematics Intern
  May 2022-August 2022.
  Researched and analyzed cryptographic attacks and post quantum cryptosystems.
  Received Top Secret (TS) clearance. Received Sensitive Information (SI) clearance.
  One out of four students chosen to brief the Director/Deputy Director of the NSA, Forte Meade, MD, U.S.A, July 2022.

- **Markov Chains Research Experience Undergraduates,** University of Connecticut.
  June 2021 - June 2022.
  Sponsored by the National Security Agency (NSA).
  Researched the quasi-stationary distribution for the Invasion Model on a complete bipartite graph.
  Advisor: Dr. Iddo Ben-Ari.

Publications

- **Quasistationary Distribution for the Invasion Model on a Complete Bipartite Graph**
  (with I. Ben-Ari, C. Allard, S. Chand, V. Hovenga, E. Lee), submitted, arXiv:2204.10287

- **Multishot Adversarial Network Decoding**
  (with G. Cotardo, G L. Matthews, A. Ravagnani), In 59th Annual Allerton Conference on Communication, Control and Computing (Allerton) Proceedings, Monticello, IL, USA, 2023.

Awards, Honors, Prizes, and Grants

- **2024 Outstanding Master's Student in the VT College of Science**, Nominated for the Outstanding Masters award by the Mathematics Department and selected for my demonstrated excellence in one or more of the tripartite missions of Virginia Tech (teaching, research, and outreach).

- **Most Astute Presentation,** Commonwealth Cyber Initiative (CCI) Graduate Student Summit for my presentation Multishot Capacity of Adversarial Networks", November 2023.

- **CCI SWVA Cyber Innovation Scholar**, CCI Virginia Tech, April 2023. Awarded for my interest in exploring avenues to commercialize my research.

- **Honorable Mention**, SIAM SEAS Student Award, March 2023.

- **SUNY Chancellors Award for Student Excellence**, State University of New York, March 2022. First mathematics student to win this award. This award recognizes students for exceptional achievements in SUNY's five pillars: academic excellence, leadership, campus involvement, community service, or the arts. It is the highest honor bestowed upon a student by the University.

Presentations at Conferences, Workshops, Schools, and Seminars

- **Network Coding and Capacity of Adversarial Networks**
  Virginia Tech Mathematics Department Visitor's Day 2024, February 2024.

- **Recent Results on the Multishot Capacity of an Adversarial Network**
  Virginia Tech Math Graduate Student Seminar, February 2024.

- **Multishot Adversarial Network Decoding**
  Postgraduate International Coding Theory Seminar (PICS), Virtual, February 2024.

- **Recent Results on the Multishot Capacity of an Adversarial Network**
  Joint Mathematics Meetings (JMM), San Francisco, CA, U.S.A, January 2024

- **Multishot Capacity of Adversarial Networks**
  Virginia Tech Department of Mathematics Research Day, Blackburg, VA, U.S.A, November, 2023

- **Multishot Capacity of Adversarial Networks**
  Commonwealth Cyber Initiative Graduate Student Summit, Blacksburg, VA, U.S.A, November, 2023

- **Multishot Capacity of Adversarial Networks**
  SIAM Student Chapter Lightning Talks, October 2023

- **Multishot Adversarial Network Decoding**
  59th Annual Allerton Conference on Communication, Control, and Computing, Monticello, Illinois

- **Multishot Adversarial Network Decoding**
  SIAM AG23, Eindhoven, the Netherlands, July 2023

- **On the Multishot Capacity of an Adversarial Network**
  Virginia Tech Algebra Seminar, Blacksburg, VA, U.S.A, April 2023

- **NEEC Logistics for Quantum Computing Quadratic Assignment Problem**
  10th Annual Hume Center and IC CAE Colloquium, Blacksburg, VA, U.S.A, April 2023

- **Multishot Adversarial Network Decoding**
  SIAM-SEAS at Virginia Tech, Blacksburg, VA, U.S.A, March 2023

- **Quasistationary Distributions on the Invasion Model**
  Joint Mathematics Meetings, Boston, MA, U.S.A, January 2023

- **Network Coding**
  Workshop "ACTiV(T) Week", Blacksburg, VA, U.S.A, November 2022

- **Post Quantum Cryptography**
  "KRYPTOS & CMI" Lightning Talks, Fort Meade, MD, U.S.A, July 2022

- **Quasistationary Distributions for the Invasion Model**
  Conference "Markov Chains REU", hosted online, July 2021

Poster Presentations at Internal Conferences, Workshops and Schools

- **NEEC Logistics for Quantum Computing Quadratic Assignment Problem**
  NEEC Student Day 2023, Dalgreen, VA

- **Network Communications with Adversarial Noise**
  2nd Annual CCI Symposium, Richmond, VA, April 2023

- **NEEC Logistics for Quantum Computing Quadratic Assignment Problem**
  10th Annual Hume Center and IC CAE Colloquium, Blacksburg, VA, U.S.A, April 2023

- **Network Communications with Adversarial Noise**
  Commonwealth Cyber Initiative (CCI) research showcase at Virginia Tech, April, 2023

- **Multishot Adversarial Network Decoding**
  Graduate and Professional Student Senate (GPSS) Research Symposium, March 2023

Participation in Conferences, Workshops and Schools

- Conference "Joint Mathematics Meetings (JMM)", San Francisco, CA, U.S.A, January 2024

- Conference "59th Annual Allerton Conference on Communication, Control, and Computing", Monticello, Illinois, September, 2023

- Conference "SIAM Conference on Applied Algebraic Geometry" hosted by Eindhoven University of Technology (TU/e), Eindhoven, the Netherlands, July, 2023

- Conference "2nd Annual CCI Symposium" hosted by CCI, Richmond, VA, U.S.A, April, 2023

- Workshop "CCI SWVA Cyber Innovation Scholars Workshop" hosted by CCI SWVA, Blacksburg, VA, U.S.A, April 2023

- Conference "SIAM SEAS at Virginia Tech", Blacksburg, VA, U.S.A, March 2023

- Workshop "Magma" hosted by G. Cotardo, Blacksburg, VA, U.S.A, March 2023

- Conference "ALCOCRYPT: ALgebraic and combinatorial methods for COding and CRYPTography", Marseille, France, February 2023

- Conference "Joint Mathematics Meetings (JMM)", Boston, MA, U.S.A, January 2023

- Workshop "ActiV(T) Week" organized by G. Cotardo, G. Matthews and W. Santos, Blacksburg, VA, U.S.A, November 2022

Travel Grants

- Graduate and Professional Student Senate (GPSS) Award, $500 for travel to SIAM AG23, July, 2023

- SIAM Student Travel Award, from the Society for Industrial and Applied Mathematics, in connection with theconference "SIAM AG23", Eindhoven, The Netherlands, July 2023

- Cyber Innovation Scholar $2000 Professional Travel Grant, from the Commonwealth Cyber Initiave (CCI) Southwest Virginia, April 2023

- Financial support of Centre International de Rencontres Mathématiques (CIRM) provided for attendance of the conference "ALCOCRYPT: ALgebraic and combinatorial methods for COding and CRYPTography", Marseille, France, December 2022

- Graduate and Professional Student Senate (GPSS) Award, $300 for travel to JMM 2023, Boston, MA, January, 2023

Teaching Experience

- **University at Buffalo**, January 2020 - May 2022
  Teaching Assistant for the following courses: Calculus III, Discrete Mathematics, How the Internet Works, Statistical Methods

Public Engagement, Outreach and Service

- In February 2024, I helped organize the Virginia Tech Visitor's Day, participated in walking tours, panels and gave talks about my research.

- In February 2024, I organized (jointly with N. Swanson) a Blacksburg Math Circle session on modular arithmetic and the importance of the Discrete Log problem in cryptography.

- In January 2024, I was a poster reviewer for the Undergraduate Pi Mu Epsilon poster session

- Since December 2023, I am a graduate ambassador for the VT Department of Mathematics. My role is to help answer student questions about life in graduate school and job opportunities

- In November 2023, I organized (jointly with the VT Association for Women in Mathematics) the Virginia Tech science fair activity "The Mathematics of How We Send Secret Messages", focused on cryptography

- In October 2023, I organized (jointly with K. Karcher) a second session on cryptography as a part of the VT Math Circle. We focused on shift ciphers and substitution ciphers

- In September 2023, I organized (jointly with G. Cotardo and G. Matthews) an event called "Quantum and the Intelligence Community: Dive-in!" focused on quantum computing job/internship opportunities in industry and government. This event was sponsored by the Commonwealth Cyber Initiative, VT Quantum and NSA

- In September 2023, I organized (jointly with N. Swanson) a VT math circle session on the encryption and decryption of messages using RSA and Reed-Solomon codes.

- In April 2023, I organized (jointly with K. Karcher) a session on the mathematics behind the games 'Set' and 'EvenQuads' as a part of the VT math circle

- In March 2023, I organized (jointly with G. Cotardo) a session on binary numbers and hexadecimal representation of colors as a part of the VT Math Circle

- In October 2022, I organized (jointly with K. Karcher) a session on cryptography as a part of the VT Math Circle

- In October 2022, I volunteered in aiding in activities as part of the VT MORE workshop and was a panelist for students to answer questions about graduate school in mathematics. The purpose of this conference was to bring together undergraduate students and inspire them to pursue a graduate degree in mathematics

- In the year of August 2021-May 2022, I was the president of the Mathematics club at University at Buffalo. Through being president, I conducted resume reviews for undergraduates and workshops in LaTeX and helped students apply to research experiences for undergraduates (REU) and internships

- In the year of August 2021-May 2022, I was the ambassador of the Mathematics Department at University at Buffalo. This position aimed to share experiences as a mathematics students with others to encourage students to become more involved in the department and gain experiential learning opportunities

Memberships

- **Nominated member of Sigma Xi Virginia Tech Chapter**, April 2023-Present.
- **Nominated Student Member of SIAM**, March 2023-Present.
- **Member of the VT SIAM Student Chapter**, December 2022-Present.
- **Nominated Student Member of AMS**, December 2022-Present.
- **Member of the Applied Algebra Research Group (AARG),** lead by my advisor, G. Matthews, August 2022-Present.
- **Member of Phi Beta Kappa**, May 2022-Present.

Skills

- **Languages:** Python (Intermediate)
- **Programming:** Cryptol (Intermediate), LaTeX(Intermediate), MAGMA (Basic)
- **Softwares:** MATLAB(Intermediate)

Generalities

Nationality: American
Languages: English (Native), Spanish (Basic)