

# Neil Epstein

Assistant Professor  
Department of Mathematical Sciences  
George Mason University

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nepstei2@gmu.edu

<http://math.gmu.edu/~nepstei2>

## Professional history

- Swarthmore College, B.A. (Mathematics and Linguistics), with High Honors, 1998
- University of Chicago, M.S. (Mathematics), 2000
- University of Kansas, Ph.D. (Mathematics), 2005
- University of Michigan, NSF Postdoctoral Fellowship (Mathematics), 2005-2009
- University of Osnabrueck, DFG Postdoctoral Fellowship (Mathematics), 2009-2012
- George Mason University, Assistant Professor (Mathematical Sciences), 2012-present

## Research interests

My research concerns commutative algebra, the theory of systems that admit operations of addition, multiplication and subtraction. Commutative algebra is a central topic in modern mathematics. To date, my work has concentrated mostly on fundamental problems within commutative algebra. It has had close connections with algebraic geometry, combinatorics, and continuous functions. More broadly, commutative algebra has applications to statistics, cryptography, phylogenetics, mass action chemistry, and integer programming. Recently I am also involved in a project of identifying correlated mutations in big data genetics.

## Publications

### Refereed publications as a GMU professor:

21. Neil Epstein and Mel Hochster, *Continuous closure, axes closure, and natural closure*, arXiv:1106.3462, to appear in Trans. Amer. Math. Soc.
20. Neil Epstein and Javid Validashti, *Hilbert-Kunz multiplicity of products of ideals*, arXiv:1601.00014, to appear in J. Commut. Algebra.
19. Neil Epstein and Jay Shapiro, *Perinormality in pullbacks*, arXiv:1511.06473, to appear in J. Commut. Algebra.
18. Neil Epstein and Bernd Ulrich, *Liftable integral closure*, arXiv:1309.6966, to appear in J. Commut. Algebra.
17. Neil Epstein and Yongwei Yao, *Some extensions of Hilbert-Kunz multiplicity*, Collect. Math. **68** (2017), no. 1, 69–85.

16. Neil Epstein and Jay Shapiro, *Perinormality – a generalization of Krull domains*, J. Algebra **451** (2016), 65–84.
15. Neil Epstein and Jay Shapiro, *A Dedekind-Mertens theorem for power series rings*, Proc. Amer. Math. Soc. **144** (2016), no. 3, 917–924.
14. Neil Epstein and Jay Shapiro, *The Ohm-Rush content function*, J. Algebra Appl. **15** (2016), no. 1, 1650009, 14 pp.
13. Neil Epstein, *Semistar operations and standard closure operations*, Comm. Algebra **43** (2015), no. 1 (Special Issue, dedicated to Marco Fontana), 325–336.
12. Neil Epstein and Karl Schwede, *A dual to tight closure theory*, Nagoya Math. J. **213** (2014), 41–75.
11. Neil Epstein and Jay Shapiro, *Strong Krull primes and flat modules*, J. Pure Appl. Algebra **218** (2014), no. 9, 1712–1729.
10. Neil Epstein and Hop D. Nguyen, *Algebra retracts and Stanley-Reisner rings*, J. Pure Appl. Algebra **218** (2014), no. 9, 1665–1682.
9. Neil Epstein, *A guide to closure operations in commutative algebra*, in Progress in Commutative Algebra 2, 1–37, Walter de Gruyter, Berlin, 2012.

**Previous refereed publications:**

8. Neil Epstein and Peyman Nasehpour, *Zero-divisor graphs of nilpotent-free semigroups*, J. Algebraic Combin. **37** (2013), no. 3, 523–543.
7. Neil Epstein and Yongwei Yao, *Criteria for flatness and injectivity*, Math. Z. **271** (2012), no. 3-4, 1193–1210.
6. Joseph P. Brennan and Neil Epstein, *Noether normalizations, reductions of ideals, and matroids*, Proc. Amer. Math. Soc. **139** (2011), no. 8, 2671–2680.
5. Neil Epstein, *Reductions and special parts of closures*, J. Algebra **323** (2010), no. 8, 2209–2225.
4. Neil Epstein and Adela Vraciu, *A length characterization of \*-spread*, Osaka J. Math. **45** (2008), no. 2, 445–456.
3. Neil Epstein, *Phantom depth and stable phantom exactness*, Trans. Amer. Math. Soc. **359** (2007), 4829–4864.
2. Neil Epstein, *Phantom depth and flat base change*, Proc. Amer. Math. Soc. **134** (2006), 313–321.
1. Neil Epstein, *A tight closure analogue of analytic spread*, Math. Proc. Cambridge Philos. Soc. **139** (2005), no. 2, 371–383.

**Preprints and projects:**

- (preprint) Neil Epstein and Jay Shapiro, *The Ohm-Rush content function II. Noetherian rings, valuation domains, and base change*, arXiv:1703.02144, 2017, submitted.

(preprint) Neil Epstein and Yongwei Yao, *A computation concerning relative Hilbert-Kunz multiplicities*, arXiv:1605.01807 [math.AC], 2016.

(project) Neil Epstein and Iosif Vaisman, *Algebraic mutagenic analysis of influenza and dengue*, preliminary.

## Fellowships, Affiliations, and Awards

- MAA Project NExT (New Experiences in Teaching) fellow, 2012-13
- Research fellowship, University of Michigan: Summer 2008
- NSF Mathematical Sciences Postdoctoral Research Fellowship: Summer 2005-Spring 2009
- Supplemental Scholarship: Spring 2005
- U.G. Mitchell Graduate Scholarship (U. Kansas internal award): Summer 2004
- Member: American Mathematical Society, most years since 2003

## Teaching

### Courses at Mason

- Math 621 (Algebra I, graduate level), Spring 2018, scheduled.
- Math 629 (Homological Algebra), Fall 2017, scheduled.
- Math 321 (Abstract Algebra), Fall 2017, scheduled.
- Math 213 (Analytic Geometry and Calculus III), Summer 2017 (A session).
- Math 203 (Linear Algebra), Spring 2017, two sections.
- Math 724 (Commutative Algebra), Fall 2016.
- Math 290 (Introduction to Advanced Mathematics)<sup>1</sup>, Fall 2016.
- Math 213, Summer 2016 (A session).
- Math 213, Spring 2016, two sections.
- Math 290, Spring 2015.
- Math 213, Spring 2015
- Math 301 (Number Theory), Fall 2014.

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<sup>1</sup>I ran this as a flipped course both times, mostly using videos of a colleague (David Singman) but also some of my own.

- Math 114 (Analytic Geometry and Calculus II), Fall 2014.
- Math 113 (Analytic Geometry and Calculus I), Spring 2014.
- Math 629 (Commutative Algebra II), Fall 2013.
- Math 621, Spring 2013.
- Math 321<sup>2</sup>, Fall 2012.

### Courses at Michigan

- Differential Equations, 4 semesters (6 sections total), 2006-2009.
- Commutative Algebra, Fall semester, 2007.

### Courses at Kansas

- Calc II, Spring semester 2005.
- Calc I, Fall semester, 2003.

### Courses at Chicago

- “Mathematical methods for the social sciences” (Calc III), Spring quarter, 2002.
- Calc II, Winter quarters 2001 **and** 2002.
- Calc I, Fall quarters 2000 **and** 2001.

## Students, advising, and training

- Iosif Vaisman and I ran the project “Algebraic Tools in Bioinformatics” as a constituent part of *Mason Modeling Days*, a 4-day intensive training session for undergraduates, graduate students, and faculty. Our project had about 20 people. June 28-July 1, 2017, Key Bridge Marriott, Arlington VA.
- Jay Shapiro and I ran a weekly algebra seminar for graduate students during both semesters of 2013 and Spring semester of 2014.
- I advised an undergraduate research project for Anna-Rose Wolff. She presented a poster at the 2014 Joint Mathematics Meetings detailing the status of the project at that time.
- Ph.D. advisor for: George Whelan (January 2013-May 2017) and Thomas Ales (September 2015-present)
- George Whelan successfully defended his thesis April 12, 2017, and graduated at Spring commencement.

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<sup>2</sup>Following a method I learned as a Project NExT fellow, I ran a course in abstract algebra that involved a structured series of homework assignments, some of which would be done as class group work. No lecturing was involved.

- M.S. advisor for: Anna-Rose Wolff (Fall 2014-Spring 2015)
- Host advisor for Dario Spirito, a Ph.D. student of Marco Fontana of Università di Roma tre (September 2014-March 2015)
- Ph.D. dissertation committee member:
  - outside member, at Roma Tre University (Rome, Italy): for Dario Spirito
  - at Mason: for Tim Long, Amy Schmidt, Elie Alhajjar, and Jack Love
  - at Michigan: for Christopher Mueller, Joseph Stubbs, Hannah Robbins, and Tigran Ananyan
  - at Osnabrück: for Peyman Nasehpour and Axel Stäbler
- M.S. committee member for Chris Gray and Kelsie Snyder (both GMU)

## Conference organization

- Co-organizer (with Karl Schwede and Janet Vassilev) of the AMS special session “Commutative algebra in all characteristics”, at the Joint Mathematics Meetings in San Diego, 2018, scheduled.
- Co-organizer (with Alan Loper) of the AMS Special Session “Commutative ring theory (in honor of Jay Shapiro’s retirement)”, Southeastern Sectional meeting of the American Mathematical Society, November 2016, Raleigh, NC.
  - 16 people gave talks of 20 minutes each in length, over a span of 2 days.
- Co-organizer (with Sean Sather-Wagstaff and Karl Schwede) of the AMS Special Session “Homological and characteristic  $p$  methods in commutative algebra”, Joint Mathematics Meetings, January 2014, Baltimore.
  - 22 people gave talks of 20 minutes each in length, over a span of 2 days.
- Co-organizer (with Lance E. Miller) of the Special Session “Closure operations in commutative algebra”, Eastern Sectional meeting of the American Mathematical Society, March 2015, Georgetown University, DC.
  - 20 people gave talks of 20 minutes each in length, over a span of 2 days.

## Invited Talks since 2012

- (title TBA) at the Special Session “Multiplicative ideal theory and factorization (in honor of Tom Lucas retirement)”, Central Sectional meeting of the American Mathematical Society, March 17 or 18, 2018, Columbus, OH, expected.
- (title TBA) at the Special Session “Homological algebra”, Central Sectional meeting of the American Mathematical Society, March 17 or 18, 2018, Columbus, OH, expected.

24. *Generic matroids – a bilevel matroid-like structure on sets with topological structure*, Arithmetic seminar, Binghamton University, April 24, 2017.
23. *The Ohm-Rush content function II. Noetherian rings and valuation domains*, at the Special Session “Factorization and multiplicative ideal theory”, Southeastern Sectional meeting of the American Mathematical Society, March 11, 2017.
22. *How well-behaved is your ring map? The Ohm-Rush content function reconsidered*, CAG seminar, GMU, March 3, 2017.
21. *How well-behaved is your ring map? The Ohm-Rush content function reconsidered*, Commutative Algebra seminar, Ohio State University, February 13, 2017.
20. *Unmixed Hilbert-Kunz multiplicity*, at the Special Session “Homological methods in commutative algebra”, Southeastern Sectional meeting of the American Mathematical Society, November 13, 2016, NCSU, Raleigh, NC.
19. *Perinormal integral domains and gluing constructions*, Algebra seminar, Georgia State University, April 12, 2016.
18. *Perinormal integral domains, part II* at the Special Session “Commutative ring theory”, Eastern Sectional meeting of the American Mathematical Society, March 19, 2016, Stony Brook University, Stony Brook, NY.
17. *Perinormality in pullbacks*, at the Special Session “Commutative algebra”, Eastern Sectional meeting of the American Mathematical Society, November 14, 2015, Rutgers University, New Brunswick, NJ.
16. *What’s in a polynomial (or power series)? A partial history of the notion of ‘content’, from 1801 to 2014*, Swarthmore College math department colloquium, October 27, 2015, Swarthmore, PA.
15. *Perinormal integral domains*, University of Virginia commutative algebra seminar, October 14, 2015, Charlottesville, VA.
14. *Perinormal integral domains and gluing constructions*, University of Michigan commutative algebra seminar, September 16, 2015, Ann Arbor, MI.
13. *The space of local overrings of an integral domain*, TAD seminar, GMU, April 24, 2015.
12. *Perinormal integral domains*, at the Special Session “Algebra and representation theory”, Eastern Sectional meeting of the American Mathematical Society, March 8, 2015, Georgetown University, DC.
11. *Closure operations in commutative algebra*, 6th Annual Research Symposium, GMU SIAM student chapter, October 3, 2014.
10. *Closure operations in commutative algebra*, at the Special Session “Directions in commutative algebra: past, present, future (dedicated to the memory of H.-B. Foxby)”, Central Sectional meeting of the American Mathematical Society, September 21, 2014, University of Wisconsin-Eau Claire.

9. *Strong Krull primes and flat modules*, CAG seminar, GMU, May 2, 2014.
8. *What's in a polynomial (or power series)? A partial history of the notion of 'content', from 1801 to 2014*, Reed College math department colloquium, April 17, 2014, Portland, OR.
7. *Strong Krull primes and flat modules*, at the Special Session "Interactions in commutative algebra", Western Sectional meeting of the American Mathematical Society, April 5, 2014, University of New Mexico, Albuquerque, NM.
6. *Some naturally occurring matroids and matroid-like structures in commutative algebra*, CAG seminar, GMU, September 20, 2013.
5. *Zero-divisor graphs of certain semigroups associated to commutative rings*, at the Invited Paper Session 'Developments in commutative algebra', MAA MathFest (summer meeting of the Mathematical Association of America), August 1, 2013, Hartford, CT.
4. *Liftable integral closure*, at the conference titled "Commutative algebra and its interactions with algebraic geometry", July 12, 2013, at CIRM, Luminy, Marseille, France.
3. *Strong Krull primes and flat modules*, as a named invited speaker, at the conference titled "Combinatorial structures in algebra and topology", July 5, 2013, Osnabrück, Germany.
2. *Zero-divisor graphs of nilpotent-free semigroups* (2 parts), CAG seminar, GMU, February 8 and March 1, 2013.
1. *Semistar operations and standard closure operations*, at the conference titled "Commutative rings and their modules", June 5, 2012, in Bressanone/Brixen, Italy.

## Service

- P&H (Policy and Hiring) Committee, GMU math department, academic years 2013-14 and 2014-15. We hired one tenure-track assistant professor, one associate professor, and two temporary term instructors the first year. In the second year, we hired three longer-term term instructors.
- Curriculum Committee, College of Science, August 2014-present.
- Undergraduate advisor, Department of Mathematical Sciences, to commence Spring semester 2018.
- Refereed papers for:
  - *Journal of Pure and Applied Algebra*
  - *Journal of Commutative Algebra*
  - *Journal of Algebra*
  - *Communications in Algebra*
  - *Proceedings of the American Mathematical Society*
  - *Mathematical Proceedings of the Cambridge Philosophical Society*
  - *Journal of Algebra and its Applications*