

# Curriculum Vitae of William J. Keith, Aug 2021

## Contact Information

Office:	Home:
314 Fisher Hall	301 E. Montezuma Ave.
1400 Townsend Drive	Houghton, MI 49931
Houghton, MI 49931	cell: 906-370-9125
campus phone: 7-2884	
email: wjkeith@mtu.edu	Skype: william.j.keith
arXiv: au:+Keith_W	Web: pages.mtu.edu/~wjkeith

## Education

Fall 2010 - Summer 2012	University of Lisbon
Postdoctorate	Supervisor: Carlos André
Fall 1999 - Summer 2007	Pennsylvania State University
Graduate study	Advisor: Prof. George Andrews
	Obtained Ph.D. Summer 2007
Fall 1995 - Summer 1999	University of Texas at Austin
Undergraduate study	B.Sc., Mathematics / B.Sc., Physics

## Research Interests

- Number Theory
  - Partition theory
- Combinatorics
  - Tableaux, symmetric functions,  $q$ -series

## Employment and Teaching Experience

Fall 2019 - Present	Michigan Tech University, Assoc. Prof.
Fall 2013 - Summer 2019	Michigan Tech University, Asst. Prof.
Fall 2012 - Spring 2013	Western Illinois University, Visiting Asst. Prof.
Fall 2010 - Summer 2012	Postdoc, University of Lisbon
Fall 2009 - Summer 2010	Drexel University, Teaching Assistant Professor
Fall 2007 - Summer 2009	Drexel University, Senior Lecturer
Fall 1999 - Spring 2007	Pennsylvania State University, Graduate assistant

## Publications

- 1.) Ranks of Partitions and Durfee Symbols. Ph.D. Thesis, PSU, June 2007.  
URL: <http://etda.libraries.psu.edu/theses/approved/WorldWideIndex/ETD-2026/index.html>
- 2.) Translation: Dieter Stockhofe, *Bijektive Abbildungen auf der Menge der Partitionen einer Natürlichen Zahl*. Appendix to thesis; see above.
- 3.) Distribution of the full rank in residue classes for odd modulus. *Discrete Mathematics* 309 (16), 28 August 2009, pp. 4960-4968. Extract of thesis. URL: <http://dx.doi.org/10.1016/j.disc.2009.02.032> .
- 4.) A bijective toolkit for signed partitions. *Annals of Combinatorics*, (2011) Volume 15, Number 1, 95-117. doi: 10.1007/s00026-011-0085-6
- 5.) Sequences of density  $\zeta(k) - 1$ . *INTEGERS* 10 (2010), Article A19, 233-241. URL: <http://www.emis.de/journals/INTEGERS/papers/k19/k19.pdf>
- 6.) Proof of a conjectured  $q, t$ -Schröder identity. *Discrete Mathematics*, Volume 310, Issue 19, 6 October 2010, Pages 2489-2494
- 7.) Recursively self-conjugate partitions. *Proceedings, INTEGERS Conference 2009*. URL: <http://www.integers-ejcnt.org/vol11a.html>, Article 12.
- 8.) A bijection for partitions with initial repetitions. *Ramanujan Journal*, Vol. 27 (2), 2011. doi:10.1007/s11139-011-9298-x
- 9.) (Joint w/ Rishi Nath, CUNY-York) Partitions with prescribed hooksets. *J. Comb. and Num. Thy*, Volume 3 (1) 2011. Preprint: <http://arXiv.org/abs/1011.1945>
- 10.) The 2-adic valuation of plane partitions and totally symmetric partitions. *Elec. Journ. of Comb.*, Volume 19 (2012), paper 48.
- 11.) (Joint w/ Robert Boyer, Drexel University) Stabilization of coefficients for partition polynomials. *INTEGERS* 13 (2013), article 56.
- 12.) A Ramanujan congruence analogue for Han's hook-length formula mod 5, and other symmetries. *Acta Arith.* 160 (2013), 303-315
- 13.) (Joint with Ângela Mestre, Univ. of Lisbon, and Christian Brouder, IPMPC) Closed forms for a multigraph enumeration. *Journal of Combinatorics and Number Theory*, 2015 Vol. 6 Number 2, pp. 37-51
- 14.) Congruences for 9-regular partitions modulo 3. *Ramanujan J.*, October 2014, Volume 35, Issue 1, pp 157-164
- 15.) (Joint w/ Giampiero Chiaselotti and Paolo Oliverio, Univ. della Calabria) Two Self-Dual Lattices of Signed Integer Partitions. *Appl. Math. and Inf. Sci.*, Volume 8, No. 6 (Nov. 2014), 3191-3199. Volume 8, No. 6 (Nov. 2014), PP:3191-3199. doi:10.12785/amis/080661
- 16.) Congruences for  $m$ -regular partitions modulo 4. *INTEGERS* 15A (2015), <http://www.integers-ejcnt.org/vol15a.html>, paper #A11
- 17.) Restricted  $k$ -colored partitions. *Ramanujan J.*, May 2016, Volume 40, Issue 1, pp 71-92. doi:10.1007/s11139-015-9704-x
- 18.) Partitions with a small number of part sizes. *Int. J. Number Theory*, 13, 229 (2017). doi:10.1142/S1793042117500130
- 19.) The part-frequency matrices of a partition. *Proceedings of the Kliakhandler Conference 2015*. doi:10.13069/jacodesmath.41075
- 20.) (Joint w/ undergraduate Sean Grindatti) Fair choice sequences. *Involve* 12 (2019) 1, 13-30. doi:10.2140/involve.2019.12.13

- 21.) (Joint with Fabrizio Zanello and graduate student Samuel Judge) On the density of odd values of the partition function. *Annals of Combinatorics*, <https://link.springer.com/article/10.1007/s00026-018-0397-x>
- 22.) (Joint with Xinhua Xiong) Euler's partition theorem for all moduli and new companions to Rogers-Ramanujan-Andrews-Gordon identities. To appear, Ramanujan J.
- 23.) (Joint with Don Kreher and Dalibor Froncek) A note on nearly platonic graphs. *Australasian Journal of Combinatorics* **70(1)** (2017), pp. 86-103
- 23a.) (Joint with Don Kreher and Dalibor Froncek) Corrigendum to: A note on nearly platonic graphs. *Australasian Journal of Combinatorics* **72(1)** (2018), page 163
- 24.) Partitions into parts simultaneously regular, distinct and/or flat. *Combinatorial and Additive Number Theory II: CANT*, New York, NY, USA, 2015 and 2016. *Springer Proceedings in Mathematics & Statistics*, Volume 220. <http://www.springer.com/us/book/9783319680309>
- 25.) Major index over descent for pattern-avoiding permutations. *INTEGERS* 18 (2018), <http://math.colgate.edu/integers/vol18.html>, paper #A55
- 26.) Families of major index distributions: closed forms and unimodality. *Elec. J. of Combinatorics*, Vol. 26 Issue 3 (2019), article P3.58. <https://doi.org/10.37236/8585>
- 27.) (Joint w/ undergraduate Emily Anible) Colored partitions and the hook-length formula: partition statistic identities. *INTEGERS 20A*, Proceedings of the Integers Conference 2018 (2020), <http://math.colgate.edu/integers/vol20a.html>, paper #A2
- 28.) A note on partitions with short profile steps. *INTEGERS* 20, <http://math.colgate.edu/integers/vol20.html>, paper A78
- 29.) Restricted  $k$ -colored partitions, II. *International Journal of Number Theory*, Proceedings of Analytic and Combinatorial Number Theory: The Legacy of Ramanujan. <https://www.worldscientific.com/doi/abs/10.1142/S1793042120400151>
- 30.) (Joint w/Fabrizio Zanello) Parity of the coefficients of certain eta-quotients. *Journal of Number Theory*. <https://doi.org/10.1016/j.jnt.2021.06.034>
- 31.) (Joint w/ Augustine Munagi) Binary Compositions and Semi-Pell Compositions. Submission, *Bulletin of the Australian Mathematical Society*
- 31.) (Joint w/Augustine Munagi, Abdulaziz Alanazi, and Bashair Alanazi) Refining Overpartitions by Properties of Non-Overlined Parts. Accepted, *Journal of Mathematics*

## Presentations

1. December 2020, Penn State Partitions Seminar: On Bergeron's  $bc - ad$  unimodality conjecture
2. October 2020, AMS Eastern Section Meeting: On Bergeron's  $bc - ad$  unimodality conjecture
3. June 2020, Combinatorics and Additive Number Theory 2020: Part-frequency matrices of partitions

4. November 2019, University of the Witwatersrand, Johannesburg, South Africa, Colloquium (**invited**): Connections between Schur functions and major index distributions
5. November 2019, AMS Sectional Meeting Gainesville, Special Session on Partition Theory and Related Topics (**invited**): Connections between Schur functions and major index distributions
6. June 2019, Analytic and Combinatorial Number Theory: The Legacy of Ramanujan (Berndt 80): *(k, j)-colored partitions: congruences and other behaviors*
7. April 2019, Graduate Colloquium Univ. of Minn. Duluth (**invited**): Distribution of the major index over standard Young tableaux
8. March 2019, Math Dept. Colloquium, Northern Michigan University: Distribution of the major index over standard Young tableaux
9. January 2019, Joint Math Meetings 2019 Baltimore, AMS Special Session on Partition Theory and Related Topics (**Invited**): *Iterated differences in Gaussian coefficients*
10. October 2018, INTEGERS Conference 2018: *Iterated differences in Gaussian coefficients*
11. July 2018, Combinatory Analysis 2018, Pennsylvania State University (**Invited**): *Unimodality of  $q$ -Binomial Differences via Kirillov/Reshetikhin*
12. Jan 2018, Joint Math Meetings 2018 San Diego, AMS Special Session on Special Functions and Combinatorics (contributed): *Refinements by descents of the  $q$ -analog of the Frame-Robinson-Thrall formula*
13. May 2017, CANT 2017, CUNY GC: *Maj over descent for pattern avoidance classes*
14. January 2017, Joint Math Meetings 2017 Atlanta, Special Session on Partition Theory and Related Topics (**Invited**): *Parity similarity formulas for partitions and multipartitions* (work joint w/ F. Zanella and S. Judge)
15. November 2017 Partitions Seminar, Pennsylvania State University (**Invited**): *Parity similarity formulas for partitions and multipartitions* (work joint w/ F. Zanella and S. Judge)
16. October 2016, INTEGERS Conference 2016: *Partitions into a small number of part sizes*
17. September 2016, Combinatorics Seminar, Michigan Tech: *Partitions into a small number of part sizes*
18. May 2016 CANT 2016, CUNY GC: *Partitions into parts simultaneously regular, distinct and/or flat*

19. Jan 2016, Joint Meetings of the AMS and the MAA: *Partitions into parts simultaneously regular, distinct, and/or flat*
20. Aug 2015, Kliakhandler Conference, Michigan Tech: *The part-frequency matrices of a partition*
21. Aug 2015, Illinois Number Theory Conference: *The part-frequency matrices of a partition*
22. Jan-Mar 2014, Combinatorics Seminar, Michigan Tech: *An introduction to partition theory* (4-part series)
23. Oct 2014, Combinatorics Seminar, Michigan Tech: *Colored partitions with restrictions on the number of colors appearing*
24. Sep 2014, AMS Central Section Meeting: *Restricted  $k$ -colored partitions*
25. Apr 2014, Combinatorics Seminar, Michigan Tech:  *$m$ -Regular partitions and eta-function symmetries*
26. Apr 2014, UMN-Duluth Combinatorics Seminar:  *$m$ -Regular partitions and eta-function symmetries*
27. October 2013, Combinatorics Seminar, Michigan Tech: *The Robinson-Schensted-Knuth Algorithm: a gentle introduction*
28. May 2013 , Departmental Colloquium, Western Illinois University: *The Indeterminate Multipartition*
29. April 2013, Number Theory Seminar, Univ. of Illinois Urbana-Champaign (Invited): *The Indeterminate Multipartition*
30. Dec 2011, Seminário do CELC, Univ. Lisbon: *Ramanujan congruence analogues for the Han/Nekrasov-Okounkov formula*
31. Oct 2011, Integers Conference 2011, University of West Georgia: *Ramanujan congruence analogues for the Han/Nekrasov-Okounkov formula*
32. Sep 2011, 67th Séminaire Lotharingien de Combinatoire, Bertinoro, Italy: *Vexillary involutions and Motzkin paths* (joint w/Maria Torres and Fátima Rodrigues)
33. Mar 2011, Combinatorics Seminar, University of Coimbra: *Counting simultaneous  $s/t$ -core partitions* (50 min. version)
34. Mar 2011,  $q$ -Series Conference 2011, Georgia Southern University: *Counting simultaneous  $s/t$ -core partitions* (20 min. version)
35. Nov 2010, Seminário do CELC, Univ. Lisbon: *Partitions as a bridge between settings*

36. Jan 2010, Combinatorics and Probability Seminar, Univ. of Penn. *Proof of a conjectured  $q, t$ -Schröder identity*
37. Nov 2009, CUNY-York Number Theory Seminar: *Recursively Self-Conjugate Partitions* (50 min. version)
38. Oct 2009, INTEGERS 2009, AMS 2009 East. Sec. Mtg (Invited): *Recursively Self-Conjugate Partitions* (20 min. version)
39. Dec 2008, Combinatory Analysis 2008, Penn State: *Partitions in  $\mathbb{Z}_p$*
40. Feb 2008, Departmental Colloquium, Drexel University: *Signed Partitions: New Theorems for Old*
41. April 2007, Graduate Student Combinatorics Conf., U. Washington: *Flat Partitions, Permutation Descents, and Classical Partition Identities*
42. Oct 2006, Midwest Number Theory Conf. for Graduate Students IV, U. Illinois: *Congruences for the Full Rank*
43. April 2006, Graduate Student Combinatorics Conf., U. Wisconsin-Madison: *Lecture Hall Partitions Generalized Toward Glaisher*
44. Feb 2004, Partitions Seminar, Penn State: *Fibonacci-Like Sequences Among Hyperbinary Partitions*

## Advising and Thesis Committees

Spring 2021	Thesis committee (external examiner), Ntendeni Annah Takalani Univ. Witwatersrand (Supv. Augustine Munagi)
Fall 2020 - Spring 2021	Doctoral committee, Tim Wagner (Supv. Fabrizio Zanella)
Fall 2020, ongoing	Undergraduate advisor, Discrete Mathematics major concentration
Fall 2019, ongoing	Advisor, Master's thesis, Emily Anible
Summer 2018	MA 4990 Undergraduate research, Emily Anible
Summer 2018	SURF Project, Marshal Dunham
Jan 2016 - Spring 2017	Advisor, Master's thesis, J. T. Davies
Summer 2015 - Spring 2018	Doctoral committee, Samuel Judge (Sup. Fabrizio Zanella)
Spring 2013	Thesis committee (external examiner), Miehleketo Ndlovu Univ. Witwatersrand (Supv. Augustine Munagi)
2010	Thesis committee, Derek Heilman Drexel Univ. (Supv. Jennifer Morse)

## Awards and Honors

- Spring 2018 Outstanding Research Award, Assistant Professor Rank, MTU  
*Quality of research among Math Dept. Asst. Profs. at Michigan Tech*
- Spring 2006 ZZRQ Award, Penn State  
*For service rendered to the Department by a graduate student*
- Fall 2005 Departmental Award for Graduate Teaching  
*(Shared: <http://www.math.psu.edu/about/giving/grad-teaching.php>)*

## Professional Service

- Fall 2021 - Spring 2024 MTU Faculty Senator, Dept. of Math. Sciences
- Spring 2021, ongoing Organizer, multi-University Specialty Seminar in Partition Theory
- Spring 2021 Organizer, special session in Partition Theory,  
January 2022 AMS Joint Meetings  
(w/ D. Eichhorn UC-Irvine and B. Kronholm UT-RGV)
- Fall 2018, ongoing Team advisor, MTU Putnam Exam team
- Jan 2016, ongoing Reviewer, Zentralblatt Math
- Fall 2015, ongoing Reviewer, Mathematical Reviews
- Spr. 2013, ongoing Organizer, MTU Algebra & Combinatorics Seminar
- Fall 2013, ongoing Undergraduate Committee, MTU Math Dept
- Ongoing Referee work for journals
- Spring 2010 Team advisor, Mathematical Contest in Modeling
- 2007 - 2010 Variety of Drexel Math Dept events as needed
- Fall 2007 Volunteer, Fall 2007 EPaDel section MAA meeting
- Fall 2003 - Spring 2007 Organizer, Penn State Slow Pitch Seminar
- Fall 2004 - Spring 2005 Math Dept. Rep., Graduate Student Association

## Grants and Funding

1. August 2020 (joint w/ David Hemmer): NSF REU Site: Partitions and Representation Theory at Michigan Technological University. Rejected.
2. August 2019 (joint w/ David Hemmer, Vladimir Tonchev, and Zeying Wang): NSF REU Site: Codes, Combinatorics & Designs at Michigan Technological University. Rejected.
3. September 2018: NSF Combinatorics program. Project: Algebraic and combinatorial approaches to parity in partitions. Rejected.
4. July 2018: NSF CAREER proposal. Project: Algebraic and combinatorial approaches to parity in partitions. Rejected.
5. January 2018: SURF funding, student Marshal Dunham. Project: Enumeration of tree-like tableaux. Approved.
6. Applied, September 2017: NSF Combinatorics program. Project: Distribution of statistics for standard Young tableaux. Rejected.

7. Applied, September 2015: NSF Combinatorics program. Project: A unified structural framework for the  $m$ -regular partitions. Rejected.
8. Visiting speaker funding, Visiting Women and Minority Lecturer and Scholar Series, for visit of Bridget Tenner (DePaul) to Combinatorics Seminar, Fall 2015. Approved.