Mark E. Walker

November 29, 2024

Education:

B.S (Mathematics, with Honors)	1990	New Mexico State University
M.S. (Mathematics)	1992	University of Illinois
Ph.D. (Mathematics)	1996	University of Illinois

Thesis advisor: Daniel Grayson

Professional Experience:

Visiting Assistant Professor	1996 – 1998	University of Nebraska–Lincoln
Visiting Scholar	Jan. – Mar. 1997	Northwestern University
Visiting Scholar	Sep. – Dec. 1997	Northwestern University
Visiting Scholar	Jan. – April 1999	Rutgers University
Assistant Professor	1998 – Aug. 2002	University of Nebraska–Lincoln
Associate Professor	Aug. 2002 – Aug. 2006	University of Nebraska–Lincoln
Professor	Aug. 2006 – present	University of Nebraska–Lincoln

Willa Cather Professor of Mathematics since 2014

Major Awards:

- Fellow of the American Mathematical Society (since 2020)
- UNL College of Arts and Sciences Outstanding Research and Creativity (ORCA) Award (in 2022)

Research Interests:

Algebraic K-theory, commutative algebra, and non-commutative algebraic geometry.

Current Ph.D. students:

Nawaj KC (joint with Jack Jeffries), Ben Katz

Former Ph.D. students:

Andrew Soto Levins (2024), Matthew Bachmann (2023), Micheal DeBellevue (joint with Alexandra Seceleanu) (2022), Erica Hopkins (joint with Alexandra Seceleanu) (2021), Eric Hopkins (2021), Amadeus Martin (2021), Nick Packauskas (joint with L. Avramov) (2019), Josh Pollitz (joint with L. Avramov) (2019), Seth Lindokken (2018), Andrew Windle (2017), Peder Thompson (2016), Michael Brown (2015), Jason Hardin (2014), Xuan Yu (2013), Olgur Celikbas (jointly supervised with Roger Wiegand) (2010), Mu-wan Huang (2009), Xuyen (Suanne) Au (2009)

Recent Grants:

- NSF, "FRG: Collaborative Research: Homotopical Methods in Algebraic Geometry" (with Aravind Asok, Eric Friedlander, Christian Haesemeyer and Chuck Weibel), 2010 – 2014. $1.5 million.
- Simons Foundation, Collaboration Grant for Mathematicians, "Singularity categories, K-theory and A-infinity-algebras", September 2014 – August 2019, $35,000.

  %item NSF, "KUMUNU 2019–21", August 23, 2019 – present. $38,151. This grant supported three KUMUNU conferences.
- NSF Grant, "Free resolutions, K-theory, and dg-categories", June 1, 2019– May 31, 2022. $257,571.
- NSF Grant, "Multiplicities of modules and complexes, and the nc Hodge conjecture" June 1, 2022 – May 31 2025. $282,638.
- NSF RTG Grant, "Commutative Algebra at Nebraska", 2024-2028. $1,745,901.

Publications:

[1] *How Hamiltonian can a finite group be?* (with Gary J. Sherman and Thomas J. Tucker) **Archiv der Mathematik**, **57** (1991), 1-5.

[2] *Rewriteability in finite groups*; (with Gary J. Sherman and Judy L. Leavitt) **American Mathematical Monthly**, **99** (1992) No. 5, 446-452.

[3] *The primitive topology of a scheme*; **Journal of Algebra**, **201** (1998), 656–685.

[4] *Adams operations for bivariant* K*-theory and a filtration using projective lines*; **K-theory**, **21**, No. 2 (2000), 101–140.

[5] *Weight zero motivic cohomology and the general linear group of a simplicial ring*; **Journal of Pure and Applied Algebra**, **147** (2000), 311–319.

[6] *Weight one motivic cohomology and* K*-theory*; **American Journal of Mathematics**, **123** (2001), 1–35.

[7] *Function spaces and continuous algebraic pairings for varieties* (with Eric Friedlander); **Compositio Mathematica**, **125** (2001), 69–110.

[8] *Geometric models for algebraic K-theory* (with Dan Grayson); **K-theory**, **20**, No. 4 (2000), 311–330.

[9] *Semi-topological K-theory using function complexes* (with Eric Friedlander); **Topology**; **41**, Issue 3 (2002) 591–644.

[10] *Comparing K-theories for complex varieties* (with Eric Friedlander); **American Journal of Mathematics, 123** (2001), 779–810.

[11] *Some remarks concerning mod-n K-theory* (with Eric Friedlander); **Inventiones Mathematicae, 145** (2001), 545–555.

[12] *Semi-topological K-theory of real varieties* (with Eric Friedlander); **Proceedings of the International Colloquium on Algebra, Arithmetic and Geometry, Mumbai 2000, Part I** (2002); pp. 219–326.

[13] *Semi-topological K-homology and Thomason's theorem*; **K-theory**, **26** (2002), 207–286.

[14] *Rational isomorphisms between K-theories and cohomology theories*; (with Eric Friedlander); **Inventiones Mathematicae, 154** (2003) 1–61.

[15] *Thomason's Theorem for varieties over algebraically closed fields*; **Trans. Amer. Math. Soc., 356** (2004) 2569–2648 (electronic).

[16] *Techniques, computations, and conjectures for semi-topological K-theory* (with Eric Friedlander and Christian Haesemeyer); **Math. Ann.**, **330** (2004) 759–807.

[17] *Semi-topological K-theory* (with Eric Friedlander), pp. 877–924 in **Handbook of K-theory** (2005), E. M. Friedlander and D. R. Grayson editors. This is a chapter in a refereed collection on topics pertaining to K-theory and motivic cohomology.

[18] *Homology of linear groups via cycles in $BG \times X$* (with Kevin Knudson); **The Journal of Pure and Applied Algebra, 192** (2004), 187–202.

[19] *Chern classes for twisted K-theory*; **The Journal of Pure and Applied Algebra, 206** (2006), 153-188.

[20] *The morphic Abel-Jacobi map*; **Compositio Mathematica, 143** (2007), 909–944.

[21] *Sir Michael Atiyah's Einstein lecture: "The nature of space"* (with G. W. Johnson); **Notices Amer. Math. Soc.**, **53** (2006), 674–678.

[22] *A new proof of the New Intersection Theorem* (with G. Piepmeyer); **Journal of Algebra**, **322** (2009), 3366–3372.

[23] *The K-theory of toric varieties* (with G. Cortiñas, C. Haesemeyer, and C. Weibel); **Trans. Amer. Math. Soc.**, **361** (2009), 3325–3341.

[24] *Bass' NK groups and cdh-fibrant Hochschild homology* (with G. Cortiñas, C. Haesemeyer, and C. Weibel); **Inventiones Mathematica**, **181** (2010), 421–448.

[25] *The equivariant K-theory of toric varieties* (with Suanne Au and Mu-wan Huang); **The Journal of Pure and Applied Algebra**, **213** (2009), 840–845.

[26] *Hochster's Theta invariant and the Hodge-Riemann bilinear relations* (with Frank Moore, Greg Piepmeyer and Sandra Spiroff); **Advances in Mathematics**, **226** (2011) 1692–1714.

[27] *K-theory of cones of smooth varieties* (with G. Cortiñas, C. Haesemeyer, and C. Weibel), **J. Algebraic Geometry**, **22** (2013) 13–34.

[28] *A negative answer to a question of Bass* (with G. Cortiñas, C. Haesemeyer, and C. Weibel), **Proceedings of the AMS**, **139** (2011), 1187–1200.

[29] *Hochster's theta pairing and algebraic equivalence* (with Olgur Celikbas), **Math. Ann.**, **353** (2012) 359–372.

[30] *Toric Varieties, monoid schemes and cdh descent* (with G. Cortiñas, C. Haesemeyer, and C. Weibel), **Journal für die reine und angewande Mathematik** (Crelle's journal), **698** (2015) 1–54.

[31] *The vanishing of a higher codimension analog of Hochster's theta invariant* (with Frank Moore, Greg Piepmeyer and Sandra Spiroff), **Math Z. 273** (2013), no. 3-4, 907–920.

[32] *Matrix factorizations over projective schemes* (with Jesse Burke); **Homotopy, Homology, and Applications**, **14** (2012) 37–61.

[33] *Matrix factorizations in higher codimension* (with Jesse Burke), **Trans Amer. Math. Soc.**, **367** (2015) 3323–3370.

[34] *The K-theory of toric varieties in positive characteristic* (with G. Cortiñas, C. Haesemeyer, and C. Weibel). **Journal of Topology**, **7** (2014) 247–286.

[35] *On the vanishing of Hochster's theta invariant*, **Annals of K-Theory**, **2** (2017) 131–174.

[36] *Chern Characters for Twisted Matrix Factorizations and the Vanishing of the Higher Herbrand Difference*, **Selecta Math. (N.S.)**, **22** (2016), no. 3, 1749—1791.

[37] *Cyclic Adams Operations* (with Michael Brown, Claudia Miller, and Peder Thompson), **J. Pure Appl. Algebra**, **221** (2017), no. 7, 1589–1613.

[38] *Adams Operations on Matrix Factorizations* (with Michael Brown, Claudia Miller, and Peder Thompson), **Algebra and Number Theory**, **11** (2017), no. 9, 2165–2192.

[39] *Total Betti numbers of modules of finite projective dimension*, **Annals of Math. (2)**, **186** (2017), no. 2, 641–646.

[40] *The K-theory of toric schemes in mixed characteristic* (with G. Cortiñas, C. Haesemeyer, and C. Weibel), **Singularities, Algebraic Geometry, Commutative Algebra, and Related Topics: Festschrift for Antonio Campillo on the Occasion of his 65th Birthday**, 2018, edited by Gert-Martin Greuel, Luis Narváez and Sebastià Xambó-Descamps, 455–479.

[41] *Examples of finite free complexes of small rank and homology* (with Srikanth B. Iyengar), **Acta Mathematica**, **221** (2018), no. 1, 143–158.

[42] *A Chern-Weil formula for the Chern character of a perfect curved module* (with Michael K. Brown), **Journal of Non-commutative Geometry**, **14** (2020), no. 2, 709–772.

[43] *A proof of a Conjecture of Shklyarov* (with Michael K. Brown), **Journal of Non-commutative Geometry**, **16** (2022), 1479–1523.

[44] *Standard Conjecture D for Matrix Factorizations* (with Michael K. Brown). **Advances in Mathematics**, **366** (2020), 40 pages.

[45] *Adams Operations in Commutative Algebra*, in **Recent Developments in Commutative Algebra**, Springer Lecture Notes in Math., volume 2283, pages 81–116, 2021.

[46] *Maximal Cohen-Macaulay complexes and their uses: A partial survey* (with Srikanth Iyengar, Linquan Ma, and Karl Schwede). **Commutative Algebra**, 475–500, Springer, 2021.

[47] *Multiplicities and Betti numbers in local algebra via lim Ulrich points* (with Srikanth Iyengar and Linquan Ma), **Algebra & Number Theory**, Vol. 16 (2022), No. 5, 1213–1257.

[48] *Lim Ulrich sequences and Boij-Söderberg cones* (with Srikanth Iyengar and Linquan Ma), **Forum of Mathematics, Sigma**, **11**, 1–26.

[49] *Idempotent completions of equivariant matrix factorization categories* (with Michael K. Brown), **Journal of Algebra**, **634** (2023), 554–562.

[50] *The Total Rank Conjecture in Characteristic Two* (with Keller VandeBogert), to appear in **Duke Mathematical Journal**, approximately 18 pages. Preprint available at https://arxiv.org/pdf/2305.09771.pdf.

[51] *Dévissage for periodic cyclic homology of complete intersections* (with Michael K. Brown). **Annals of K-theory**, **Vol. 9, No. 2** (2024), 341–367.

[52] *Non-existence of Ulrich modules over Cohen-Macaulay local rings* (with Srikanth Iyengar, Linquan Ma, and Ziquan Zhuang), approximately 12 pages. Preprint available at https://arxiv.org/abs/2403.15566.

[53] *The Hodge structure on the singularity category of a complex hypersurface* (with Michael K. Brown).

[54] *On the Hochschild homology of curved algebras* (with an appendix by Benjamin Briggs), approximately 35 pages. Preprint available at https://arxiv.org/abs/2408.13334v1.

Recent Conference Organization:

- *Stable Cohomology: Foundations and Applications* (with Lars Christensen, Srikanth Iyengar, and Sarah Witherspoon); Snowbird, Utah; June 2018.
- *KUMUNU 2019, 2021, 2022* (with Tom Marley); Lincoln, NE; September 2019, May 2022, and October 2022.
- *JimFest: What, where, and for what purpose is the mathematics in mathematics teacher education?* (with Yvonne Lai, Allan Donsig, Elizabeth Lewis, and Judy Walker); June 2024.
- *Betti numbers in commutative algebra and equivariant homotopy theory* (with Markus Hausmann, Claudia Miller, and Marc Stephan); September 2024.