

# Karl Schwede

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CONTACT INFORMATION	Department of Mathematics The University of Utah 155 S 1400 E Room 233, Salt Lake City, UT 84112-0090	office: JWB 323 email: <a href="mailto:schwede@math.utah.edu">schwede@math.utah.edu</a> web: <a href="http://www.math.utah.edu/~schwede/">http://www.math.utah.edu/~schwede/</a>
RESEARCH INTERESTS	I do basic research in mathematics, studying algebra, geometry and particularly singularities. Much of my work is in the setting of modular arithmetic (also known as clock arithmetic), the same setting as much of our modern communication systems. Within mathematics, I work on the boundary of the fields algebraic geometry and commutative algebra. I am also interested in number theory and computational algebra.	
EDUCATION	<b>University of Washington</b> , Seattle, WA <i>Ph.D., Mathematics</i> <ul style="list-style-type: none"><li>• Advisor: Sándor Kovács</li><li>• Dissertation: On <math>F</math>-injective and Du Bois singularities</li></ul>	<b>August 2006</b>
	<b>Whitman College</b> , Walla Walla, WA <i>B.A., Mathematics (Honors)</i> <ul style="list-style-type: none"><li>• Minor: Computer Science</li><li>• Magna Cum Laude</li></ul>	<b>June 1999</b>
	<b>Bellevue Community College</b> , Bellevue, WA <i>Associate in Arts and Sciences</i>	<b>June 1997</b>
PROFESSIONAL EXPERIENCE	<b>The University of Utah</b> , Salt Lake City, UT <i>Associate Professor</i> <i>Director of Graduate Studies</i>	<b>July 2014–</b> <b>July 2015–</b>
	<b>The Pennsylvania State University</b> , State College, PA <i>Assistant Professor</i>	<b>Jan. 2011–</b> <b>June 2014</b>
	<b>MSRI</b> , Berkeley CA <i>Research Member</i>	<b>Apr.–May</b> <b>2013</b>
	<b>University of Utah</b> , Salt Lake City, UT <i>Visiting Assistant Professor</i>	<b>Fall 2010</b>
	<b>Johannes Gutenberg University Mainz</b> , Mainz Germany <i>Honorary Visiting Assistant Professor</i>	<b>June 2010</b>
	<b>MSRI</b> , Berkeley CA <i>Research Member</i>	<b>Jan.–Mar.</b> <b>2009</b>
	<b>University of Michigan</b> , Ann Arbor, MI <i>NSF Postdoc / Postdoctoral Assistant Professor / Research Fellow</i>	<b>Sept. 2006–</b> <b>July 2010</b>
	<b>University of Washington</b> , Seattle WA <i>Teaching Assistant and Instructor</i>	<b>2000–2006</b>
	<b>Havas Interactive (division of Vivendi)</b> , Walla Walla WA <i>Computer Programmer</i> developing educational software	<b>1999–2000</b>

## FUNDING

PI – NSF, <i>CAREER: Test Ideals and the Geometry of Projective Varieties in Positive Characteristic</i> , DMS-1252860/1501102	<b>Sep. 2013– Aug. 2018</b>
PI – NSF, <i>FRG: Collaborative Research: Birational Geometry and Singularities in Zero and Positive Characteristic</i> , DMS-1265261/1501115	<b>July 2013– June 2017</b>
co-PI – NSF, for conference <i>Macaulay2 Development workshop</i> , DMS- 1601205	<b>May 2016– April 2017</b>
Alfred P. Sloan Research Fellowship	<b>Sept. 2012– Sept. 2016</b>
co-PI – NSF, for conference <i>Computational Workshop on Singularities and Invariants Defined by Frobenius</i> , DMS-1160927	<b>May 2012</b>
PI – NSF, <i>Singularities in Characteristic Zero and Singularities in Positive Characteristic</i> , DMS-0969145/1064485	<b>Sept. 2010– Aug. 2013</b>
PI then co-PI – NSF, for conference <i>Frobenius splitting in algebraic geometry, commutative algebra, and representation theory</i> , DMS-0968646	<b>May 2010</b>
PI – NSF, Postdoctoral Fellowship, DMS-0703505	<b>Sept. 2007– Aug. 2010</b>

PUBLICATIONS  
*All have been  
refereed*

1. *Gluing Schemes and a Scheme Without Closed Points*. Recent progress in arithmetic and algebraic geometry, 157–172, Contemp. Math. 386. 2005
2. *A simple characterization of Du Bois singularities*. Compos. Math. 143, no. 4, 813–828. 2007
3. *Rational singularities associated to pairs*, with S. Takagi. Michigan Math. J. 57, 625–658. 2008
4. *Generalized test ideals, sharp  $F$ -purity, and sharp test elements*. Math. Res. Lett. 15, no. 6, 1251–1261. 2008
5.  *$F$ -injective singularities are Du Bois*. Amer. J. Math. 131, no 2, 445–473. 2009
6.  *$F$ -adjunction*. Algebra & Number Theory. 3, no. 8, 907–950. 2009
7. *The canonical sheaf of Du Bois singularities*, with K. Smith and S. Kovács. Adv. Math. 224, no. 4, 1618–1640. 2010
8. *A refinement of sharply  $F$ -pure and strongly  $F$ -regular pairs*. Journal of Commutative Algebra, 2, no. 1, 91–110, 2010
9. *Globally  $F$ -regular and log Fano varieties*, with K. Smith. Adv. Math. 224, no. 3, 863–894. 2010
10. *Centers of  $F$ -purity*. Math. Z. 265, no. 3, 687–714. 2010
11. *Discreteness and rationality of  $F$ -jumping numbers on rings with singularities*, with M. Blickle, S. Takagi and W. Zhang. Math. Ann., 347, no. 4, 917–949. 2010.
12. *On the number of compatibly Frobenius split subvarieties, prime  $F$ -ideals, and log canonical centers*, with K. Tucker. Ann. Inst. Fourier (Grenoble) **60** (2010), no. 5, 1515–1531.

*Publications are continued on the next page.*

PUBLICATIONS  
CONTINUED  
*All have been  
refereed*

13. *Hodge theory meets the minimal model program: a survey of log canonical and Du Bois singularities*, with S. Kovács. *Topology of Stratified Spaces* (G. Friedman, E. Hunsicker, A. Libgober, and L. Maxim, eds.), Math. Sci. Res. Inst. Publ., vol. 58, Cambridge Univ. Press, Cambridge, 2011, pp. 51–94.
14. *Test ideals in non- $\mathbb{Q}$ -Gorenstein rings*, *Trans. Amer. Math. Soc.* **363** (2011), no. 11, 5925–5941
15. *A note on discreteness of  $F$ -jumping numbers*. *Proc. Amer. Math. Soc.* **139** (2011), no. 11, 3895–3901
16. *Supplements to non-LC ideal sheaves*, with O. Fujino and S. Takagi. *Higher Dimensional Algebraic Geometry*, RIMS Kôkyûroku Bessatsu, B24, Res. Inst. Math. Sci. (RIMS), Kyoto, 2011, pp. 1–47.
17. *Semi-log canonical vs  $F$ -pure singularities*, with L. E. Miller. *J. Alg.* **349**, (2012), no. 1, 150–164.
18. *On the behavior of test ideals under finite morphisms*, with K. Tucker. *J. Algebraic Geom.* **23** (2014), no. 3, 399–443.
19. *Test ideals via a single alteration and discreteness and rationality of  $F$ -jumping numbers*, with K. Tucker and W. Zhang. *Math. Res. Lett.* **19**, (2012), no. 01, 191–197.
20. *A survey of test ideals*, with K. Tucker. *Progress in Commutative Algebra 2, Closures, Finiteness and Factorization*, Walter de Gruyter GmbH & Co. KG, Berlin, (2012), 39–99.
21. *An algorithm for computing compatibly Frobenius split subvarieties*, with M. Katzman. *J. Symbolic Comput.*, **47**, (2012), no. 8, 996–1008.
22. *Cartier modules on toric varieties*, with J.-C. Hsiao, and W. Zhang. *Trans. Amer. Math. Soc.* **366** (2014), no. 4, 1773–1795.
23. *Du Bois singularities deform*, with S. Kovács. To appear in a volume of *Advanced Studies in Pure Mathematics*. [arXiv:1107.2349](https://arxiv.org/abs/1107.2349)
24. *A canonical linear system associated to adjoint divisors in characteristic  $p > 0$* . *J. Reine Angew. Math.* **696** (2014), 69–87.
25.  *$p^{-1}$ -linear maps in algebra and geometry*, with M. Blickle. *Commutative Algebra, Expository Papers Dedicated to David Eisenbud on the Occasion of His 65th Birthday* (I. Peeva ed.), Springer New York Heidelberg Dordrecht London, 2013, pp. 123–205.
26.  *$F$ -signature of pairs and the asymptotic behavior of Frobenius splittings*, with M. Blickle and K. Tucker. *Adv. Math.* **231**, (2012) no. 6, 3232–3258.
27.  *$F$ -signature of pairs: Continuity,  $p$ -fractals and minimal log discrepancies*, with M. Blickle and K. Tucker. *J. London Math. Soc.* **87** (2013), no. 3, 802–818.
28. *Richardson varieties have Kawamata log terminal singularities*, with S. Kumar. *Int. Math. Res. Not. IMRN* **2014**, no. 3, 842–864.
29. *Bertini theorems for  $F$ -singularities*, with W. Zhang. *Proc. Lond. Math. Soc.* (3) **107** (2013), no. 4, 851–874.

*Publications are continued on the next page.*

PUBLICATIONS  
CONTINUED  
All have been  
refereed

30. *A dual to tight closure theory*, with N. Epstein. Nagoya Math. J. 213 (2014), 41-75.
31. *Depth of  $F$ -singularities and base change of relative canonical sheaves*, with Z. Patakfalvi. Journal of the Institute of Mathematics of Jussieu. **13**, no. 1, (2014) 43–63.
32. *On the numerical dimension of pseudo-effective divisors in positive characteristic*, with P. Cascini, C. Hacon and M. Mustața. Amer. J. Math. 136 (2014), no. 6, 1609-1628.
33. *Appendix:  $F$ -injectivity and depth*, with A. K. Singh. Appendix to *Deformations of  $F$ -injectivity and local cohomology* by J. Horiuchi, L. E. Miller and K. Shimomoto. Indiana Univ. Math. J. 63 (2014), no. 4, 1139-1157.
34. *A Frobenius variant of Seshadri constants*, with M. Mustața. Math. Ann. 358 (2014), no. 3-4, 861-878.
35. *Explicitly extending Frobenius splittings over finite maps*, with K. Tucker. Comm. Algebra 43 (2015), no. 10, 4070-4079.
36. *Rings of Frobenius operators*, with M. Katzman, A. K. Singh and W. Zhang. Math. Proc. Cambridge Philos. Soc. 157 (2014), no. 1, 151-167.
37. *Test ideals of non-principal ideals: Computations, Jumping Numbers, Alterations and Division Theorems*, with K. Tucker. J. Math. Pures Appl. (9) 102 (2014), no. 5, 891-929.
38.  *$F$ -singularities via alterations*, with M. Blickle and K. Tucker. Amer. J. Math. 137 (2015), no. 1, 61-109.
39. *The weak ordinarity conjecture and  $F$ -singularities*, with B. Bhatt and S. Takagi. To appear in a volume of Advanced Studies in Pure Mathematics [arXiv:1307.3763](https://arxiv.org/abs/1307.3763)
40. *Uniform bounds for strongly  $F$ -regular surfaces*, with Paolo Cascini and Yoshi-nori Gongyo. Trans. Amer. Math. Soc. 368 (2016), no. 8, 55475563.
41. *On rational connectedness of globally  $F$ -regular threefolds*, with Y. Gongyo, Z. Li, Z. Patakfalvi, H. Tanaka, and R. Zong. Adv. Math. 280 (2015), 47–78.
42. *Inversion of adjunction for rational and Du Bois pairs*, with S. Kovács. Algebra & Number Theory. 10, no. 5, 969-1000. 2016
43. *Test ideals in rings with finitely generated anti-canonical algebras*, with A. Chieccchio, F. Enescu and L. E. Miller. To appear in Journal of the Institute of Mathematics of Jussieu, [arXiv:1412.6453](https://arxiv.org/abs/1412.6453)
44. *The  $F$ -different and a canonical bundle formula*, with O. Das. To appear in Annali della Scuola Normale Superiore - Classe di Scienze, [arXiv:1508.07295](https://arxiv.org/abs/1508.07295).
45. *Positive characteristic algebraic geometry*, with Z. Patakfalvi and K. Tucker. To appear in the Proceedings of Symposia in Pure Mathematics volume for the 2015 AMS Algebraic Geometry Bootcamp, [arXiv:1412.2203](https://arxiv.org/abs/1412.2203)
46.  *$F$ -singularities in families*, with Z. Patakfalvi and W. Zhang. To appear in Algebraic Geometry (Foundation Compositio Mathematica) [arXiv:1305.1646](https://arxiv.org/abs/1305.1646)

*Publications are continued on the next page.*

PUBLICATIONS  
CONTINUED  
*All have been  
refereed*

47. *On the behavior of singularities at the  $F$ -pure threshold*, with E. Canton, D. Hernández and E. Witt. Appendix by Alessandro De Stefani, Jack Jeffries, Zhibek Kadyrsizova, Robert Walker, George Whelan. To appear in the Illinois Journal of Mathematics, [arXiv:1508.05427](#)
48. *The dualizing complex of  $F$ -injective and Du Bois singularities*, with B. Bhatt and L. Ma. To appear in Mathematische Zeitschrift. [arXiv:1512.05374](#).
49. *Discreteness of  $F$ -jumping numbers at isolated non- $Q$ -Gorenstein points.*, with P. Graf. To appear in Proceedings of the American Mathematical Society, [arXiv:1605.03825](#).
50. *Local cohomology of Du Bois singularities and applications to families.*, with L. Ma and K. Shimomoto. To appear in Compositio Mathematica. [arXiv:1605.02755](#).
51. *Fundamental groups of  $F$ -regular singularities via  $F$ -signature*, with J. Carvajal-Rojas and K. Tucker. To appear in Annales scientifiques de l'École normale supérieure. [arXiv:1606.04088](#).

SUBMITTED  
PAPERS  
/PREPRINTS

52. *Divisor package for Macaulay2*, with Z. Yang. A paper describing algorithms in a divisor package for Macaulay2. Available on my website at <http://www.math.utah.edu/~schwede/Divisor.pdf>
53. *RationalMaps, a package for Macaulay2*, with C.J. Bott, S. H. Hassanzadeh, D. Smolkin. Available on my website at <http://www.math.utah.edu/~schwede/Papers/RationalMapsPaper.pdf>
54. *Étale fundamental groups of strongly  $F$ -regular schemes*, with B. Bhatt, J. Carvajal-Rojas, P. Graf and K. Tucker. [arXiv:1611.03884](#).
55. *Perfectoid multiplier/test ideals in regular rings and bounds on symbolic powers*, with L. Ma. [arXiv:1705.02300](#).

SOFTWARE

- RationalMaps package for Macaulay2, a package for checking whether a rational map is birational/regular/an embedding. Joint with C.J. Bott, Hamid Hassanzadeh, and Dan Smolkin. The current version is available at: <https://github.com/Macaulay2/Workshop-2016-Utah> **2016–present**
- Pullback package for Macaulay2, a package for computing pullbacks in the category of rings. Joint with Drew Ellingson. It is part of the current Macaulay2 build tree: <https://github.com/Macaulay2/M2> **2015–present**
- Divisor package for Macaulay2, a package for computations with Weil divisors on normal varieties. Joint with Zhaoning Yang. It is part of the current Macaulay2 build tree: <https://github.com/Macaulay2/M2> **2014–present**
- Macaulay2 function for computing compatibly split subvarieties, joint with Mordechai Katzman. Download the current version: <http://www.math.utah.edu/~schwede/M2/FSplitting.m2> **2012–present**

*Software is continued on the next page*

SOFTWARE  
CONTINUED

- F-sing/Poschar, package for Macaulay2, a package for computing  $F$ -singularities (test ideals,  $F$ -pure thresholds, etc.). Joint with Erin Bela, Alberto F. Boix, David J. Bruce, Daniel Hernandez, Zhibek Kadyrsizova, Mordechai Katzman, Sara Malec, Pedro Teixeira and Emily Witt. Download the last stable version: <http://www.math.utah.edu/~schwede/M2/PosChar.m2> or the bleeding edge version: <https://github.com/Macaulay2/Workshop-2016-Utah/tree/master/F-sing> Documentation is available at: <http://www.math.utah.edu/~schwede/M2/DocForFSingsPackage.pdf> **2012–present**

ORGANIZATIONAL  
ACTIVITIES

- Co-organizer of an AMS Special Session, to be held at Portland State University **April 2018**
- Co-organizer of an AMS Special Session, to be held that the Joint Mathematics Meetings in San Diego **January 2018**
- Co-organizer of the conference: *Higher dimensional algebraic geometry and characteristic  $p > 0$* , held at CIRM / Luminy **Sept. 2016**
- Co-organizer of the summer school and conference: *Higher Dimensional Algebraic Geometry* held at the University of Utah **Jul. 2016**
- Co-organizer of the workshop: *Intensive Workshop for Macaulay2 Development*, held at the University of Utah **May 2016**
- Co-organizer of the AMS special session: *Algebraic Geometry*, held at the University of Utah **Apr. 2016**
- Co-organizer of the AMS-AWM special session: *Commutative Algebra and Its Interactions with Algebraic Geometry*, held at the Joint Mathematical Meetings **Jan. 2016**
- Co-organizer of the *Mathematical Research Communities Workshop on Commutative Algebra* held at Snowbird Utah **June 2015**
- Co-organizer of the *Positive Characteristic Algebraic Geometry Workshop* held at the University of Illinois at Chicago **March 2014**
- Co-organizer of the AMS special session: *Homological and characteristic  $p$  methods in commutative algebra*, held at the Joint Mathematical Meetings, Baltimore **January 2014**
- Organizer/co-organizer of the Penn State algebra and number theory seminar. **2013-2014**
- Co-organizer of the AMS special session: *Special Session on The Geometry of Algebraic Varieties*, held at Temple University **October 2013**
- Co-organizer of a mini-symposium at: *SIAM conference on Applied Algebraic Geometry*, held at Colorado State University **August 2013**

*Organizational activities are continued on the next page.*

ORGANIZATIONAL ACTIVITIES CONTINUED	<ul style="list-style-type: none"> <li>• Co-organizer of the conference: <span style="float: right;"><b>May 2012</b></span> <i>Computational workshop on Frobenius singularities and invariants</i>, held at the University of Michigan, see <a href="http://sites.google.com/site/computinginvariantsworkshop/">http://sites.google.com/site/computinginvariantsworkshop/</a></li> <li>• Co-organizer of the AMS Special Session: <span style="float: right;"><b>March 2012</b></span> <i>Singularities in Commutative Algebra and Algebraic Geometry</i>, held at the University of Kansas</li> <li>• Co-organizer of the conference: <span style="float: right;"><b>August 2011</b></span> <i>Relating test ideals and multiplier ideals</i>, held at the American Institute of Mathematics</li> <li>• Co-organizer of the conference: <span style="float: right;"><b>May 2010</b></span> <i>Frobenius splitting in algebraic geometry, commutative algebra, and representation theory</i>, see <a href="http://sites.google.com/site/frobeniussplitting/">http://sites.google.com/site/frobeniussplitting/</a></li> <li>• Assistant to the organizers of <i>Commutative algebra</i> AMS MRC summer conference/school in Snowbird Utah <span style="float: right;"><b>June 2010</b></span></li> <li>• Organizer/co-organizer of the University of Michigan commutative algebra seminar. <span style="float: right;"><b>2008–2010</b></span></li> <li>• Local organizer for Mel Hochster’s 65th birthday conference. <span style="float: right;"><b>August 2008</b></span></li> <li>• Organizer/co-organizer of the University of Michigan topics in algebraic geometry seminar. <span style="float: right;"><b>2007–2008</b></span></li> <li>• Organizer of the University of Washington algebraic geometry seminar. <span style="float: right;"><b>2004–2005</b></span></li> <li>• Co-organizer of the University of Washington undergraduate mathematical sciences seminar <span style="float: right;"><b>2004–2005</b></span></li> </ul>
OTHER PROFESSIONAL ACTIVITIES	<ul style="list-style-type: none"> <li>• Director of Graduate Studies, University of Utah. <span style="float: right;"><b>2015–present</b></span></li> <li>• Member of the following committees at the University of Utah: Graduate Committee, Graduate Recruitment Committee. Outstanding Graduate Student and Instructor Award Committee. <span style="float: right;"><b>2014–present</b></span></li> <li>• Member of the following committees at Penn State: Qualifying Exam Committee, Graduate Student Teaching Committee, Library Committee, Eberly College Outreach Council <span style="float: right;"><b>2011–2014</b></span></li> <li>• Ran a 3-week long math camp for high school students, <i>Explorations in Number Theory and Cryptography</i>, University of Utah <span style="float: right;"><b>June 2016</b></span></li> <li>• Ran a week-long math camp for high school students, <i>Spy Games: the math of secret messages</i>, within Penn State’s <i>Science-U</i> camp program. <span style="float: right;"><b>June 2013 and July 2014</b></span></li> <li>• Helped build and maintain <i>Situs Geometriae Algebraicae</i>, a website designed to help students in algebraic geometry find references. <span style="float: right;"><b>2004–2008</b></span></li> <li>• Active participant on <a href="http://www.mathoverflow.net">http://www.mathoverflow.net</a>. <span style="float: right;"><b>2010–present</b></span></li> <li>• Reviewed papers for AMS Math Reviews and Zentralblatt Math. <span style="float: right;"><b>2006–Present</b></span></li> <li>• Helped develop the University of Washington VIGRE website. <span style="float: right;"><b>2002–2003</b></span></li> <li>• Series Editor for the RSME Springer Series. <span style="float: right;"><b>2015–present</b></span> <a href="http://www.springer.com/series/13759">http://www.springer.com/series/13759</a></li> </ul>

*Other professional activities are continued on the next page.*

OTHER  
PROFESSIONAL  
ACTIVITIES  
CONTINUED

- Refereed/reviewed papers for the following journals (many with multiplicity): Journal of the American Mathematical Society, Annales Scientifiques de l'École Normale Supérieure, American Journal of Mathematics, Duke Mathematical Journal, Journal of the European Mathematical Society, Advances in Mathematics, Journal of Algebraic Geometry, Compositio Mathematica, Mathematische Annalen, Journal für die reine und angewandte Mathematik, Algebraic Geometry, Transactions of the American Mathematical Society, Mathematical Research Letters, International Mathematics Research Notices, Proceedings of the American Mathematical Society, Mathematische Zeitschrift, Discrete Math, Journal of Symbolic Computation, the Illinois Journal of Mathematics, Algebra and Number Theory, the Journal of Algebra, Journal of Pure and Applied Algebra, Communications in Algebra, Journal of Commutative Algebra, the Michigan Mathematical Journal, AMS Contemporary Mathematics, Pure and Applied Mathematics Quarterly, Manuscripta Mathematica, Central European Mathematics Journal, Canadian Journal of Mathematics, Nagoya Mathematical Journal, Journal of the London Mathematical Society, the Kyoto Journal of Mathematics, American Mathematical Monthly, Mathematical Proceedings of the Cambridge Philosophical Society, miscellaneous proceedings volumes.

2007–Present

TEACHING

**Instructor:** I have been an instructor for:

- high school level algebra, University of Washington
- precalculus, University of Washington
- calculus, University of Washington, University of Michigan
- multivariable calculus (Stokes theorem etc.), University of Washington
- topology, University of Washington
- linear algebra, University of Michigan
- honors calculus (essentially introduction to real analysis), University of Michigan
- introduction to topology, University of Washington
- introduction to schemes and cohomology, University of Michigan.
- topics course on algebraic geometry and commutative algebra, University of Utah.
- undergraduate abstract algebra, Penn State University.
- graduate-level abstract algebra, Penn State University.
- graduate-level commutative algebra, Penn State University.
- discrete mathematics (introduction to proofs), Penn State University
- honors multivariable calculus, University of Utah
- graduate abstract algebra II, University of Utah
- cryptography, University of Utah
- topics in commutative algebra, University of Utah



SELECTED TALKS	• University of Washington algebra seminar	February 2004
	• University of Michigan algebraic geometry seminar	November 2005
	• University of Washington algebra seminar	January 2006
	• Bellingham algebraic geometry seminar (BAGS)	February 2006
	• Recent Trends in Higher Dimensional Geometry, conference in Banff Canada (BIRS)	April 2006
	• Rice algebraic geometry seminar	March 2006
	• University of Michigan algebraic geometry seminar	November 2006
	• Davidson College AMS meeting, special session in commutative algebra	March 2007
	• $F$ -singularities and $D$ -modules conference in Ann Arbor	August 2007
	• University of Illinois at Chicago algebraic geometry seminar	February 2008
	• Purdue University working algebraic geometry seminar	February 2008
	• University of Georgia algebraic geometry seminar	April 2008
	• Conference in honor of Mel Hochster's 65th birthday	August 2008
	• University of Washington algebra seminar	September 2008
	• Vancouver British Columbia AMS Meeting, special session in algebraic geometry	October 2008
	• University of Illinois at Urbana-Champaign algebraic geometry seminar	October 2008
	• University of Utah commutative algebra seminar	November 2008
	• Western algebraic geometry seminar (WAGS conference)	November 2008
	• Syracuse University, colloquium	January 2009
	• University of North Carolina, colloquium	February 2009
	• University of Illinois at Urbana Champaign AMS meeting, special session in commutative algebra	March 2009
	• University of Illinois at Urbana-Champaign, colloquium	April 2009
	• Purdue University algebraic geometry seminar	April 2009
	• Commutative Algebra and its Connections to Geometry (honoring Wolmer Vasconcelos), Pan-American Advanced Study Institute, Olinda Brazil	August 2009
	• University of Kansas, algebra seminar	September 2009
	• Higher Dimensional Algebraic Geometry conference, Research Institute for Mathematical Sciences, Kyoto University, Japan	December 2009
	• Joint mathematical meetings in San Francisco, special session on commutative algebra	January 2010
	• Corcordia University, colloquium	January 2010
	• Washington University, colloquium	January 2010
	• Indiana University Bloomington, algebra seminar	January 2010
	• Indiana University Bloomington, colloquium	January 2010
	• University of Missouri, colloquium	January 2010
	• Louisiana State University, colloquium	February 2010
	• Wayne State University, colloquium	February 2010
	• Penn State University, colloquium	February 2010
	• Rice University, colloquium	February 2010
	• Sheffield University, lecture series	March 2010
	• Lexington Kentucky AMS Meeting, special session in commutative algebra	March 2010

*Talks are continued on the next page.*

SELECTED TALKS	• Harvard-MIT algebraic geometry seminar	<b>April 2010</b>
CONTINUED	• Frobenius splitting conference	<b>May 2010</b>
	• Algebra seminar, Johannes Gutenberg-Universität Mainz	<b>June 2010</b>
	• Commutative Algebra in the Southeast, Conference, Atlanta Georgia	<b>September 2010</b>
	• University of Utah, Colloquium	<b>September 2010</b>
	• Purdue University working algebraic geometry seminar	<b>October 2010</b>
	• Purdue University commutative algebra seminar	<b>October 2010</b>
	• CIRM, Luminy, Commutative algebra and its interactions with algebraic geometry	<b>November 2010</b>
	• Western algebraic geometry seminar (WAGS conference)	<b>November 2010</b>
	• Joint mathematical meetings in New Orleans, special session on commutative algebra	<b>January 2011</b>
	• Penn State University, algebra and number theory seminar	<b>February 2011</b>
	• Berkeley-Davis-Stanford Algebraic Geometry Colloquium	<b>March 2011</b>
	• University of Michigan commutative algebra seminar	<b>March 2011</b>
	• Midwest Commutative Algebra and Geometry Conference	<b>May 2011</b>
	• University of Washington, algebra and algebraic geometry seminar	<b>May 2011</b>
	• Workshop on Almost Purity, University of Michigan	<b>May 2011</b>
	• University of Osnabrück, college seminar - combinatorial structures in algebra and topology	<b>June 2011</b>
	• Johannes Gutenberg-Universität Mainz - algebra seminar	<b>July 2011</b>
	• University of Nebraska - algebraic geometry seminar	<b>August 2011</b>
	• Route 81 Conference on Commutative Algebra and Algebraic Geometry - Cornell University	<b>September 2011</b>
	• Stony Brook University, algebra, geometry and physics seminar	<b>September 2011</b>
	• University of Michigan commutative algebra seminar	<b>October 2011</b>
	• University of Utah AMS meeting, special session in commutative algebra	<b>October 2011</b>
	• Sheffield University, lecture series	<b>January 2012</b>
	• Universitat de Barcelona / Universitat Politècnica de Catalunya (joint seminar), Seminari de Geometria Algebraica	<b>January 2012</b>
	• Penn State University, GAP Seminar	<b>February 2012</b>
	• University of Illinois at Chicago, algebraic geometry seminar	<b>March 2012</b>
	• Penn State University, algebra and number theory seminar	<b>March 2012</b>
	• Princeton University, algebraic geometry seminar	<b>March 2012</b>
	• Johns Hopkins University, algebraic geometry/number theory seminar	<b>March 2012</b>
	• ACC for minimal log discrepancies and termination of flips conference, American Institute of Mathematics	<b>May 2012</b>
	• char- $p$ & $p$ -adic geometry conference, Mainz Germany	<b>June 2012</b>
	• University of Utah, algebraic geometry seminar	<b>September 2012</b>

*Talks are continued on the next page.*

SELECTED TALKS  
CONTINUED

- Ohio State University, algebraic geometry seminar **September 2012**
- Georgia State University, colloquium **October 2012**
- Georgia State University, commutative algebra seminar **October 2012**
- Johns Hopkins University, algebraic geometry/number theory seminar **November 2012**
- Princeton University, algebraic geometry seminar **November 2012**
- Trends in Arithmetic Geometry, Lorentz Center, Leiden, the Netherlands **January 2013**
- Penn State, algebra and number theory seminar **February 2013**
- University of Washington, algebra and algebraic geometry seminar **March 2013**
- Columbia University, algebraic geometry seminar **March 2013**
- Imperial College of London, 6 lectures, Workshop: Characteristic  $p$  methods in algebraic geometry **April 2013**
- Southern California Algebraic Geometry Seminar, a joint meeting of Caltech, UC Los Angeles, UC San Diego, and the University of Southern California **April 2013**
- American Institute of Mathematics, conference on The minimal model program in characteristic  $p$ . **May 2013**
- Math Science Research Institute, Conference: The Commutative Algebra of Singularities in Birational Geometry: Multiplier Ideals, Jets, Valuations, and Positive Characteristic Methods **May 2013**
- CIRM Luminy, Commutative algebra and its interactions with algebraic geometry **July 2013**
- Penn State University, algebra and number theory seminar **August 2013**
- University of Georgia, algebraic geometry seminar **September 2013**
- Georgia State University, commutative algebra seminar **September 2013**
- Johns Hopkins University, algebraic geometry/number theory seminar **October 2013**
- Birational Geometry and Singularities in Positive Characteristic, a conference at the University of Tokyo **November 2013**
- Mini-workshop on Cremona groups – University of Utah **November 2013**
- University of Illinois at Chicago algebraic geometry seminar **November 2013**
- Joint mathematical meetings in Baltimore, special session on algebraic geometry **January 2014**
- University of California at Irvine, colloquium **January 2014**
- University of California at Davis, colloquium **January 2014**
- University of Utah, colloquium **February 2014**
- University of California at Utah, algebraic geometry seminar **February 2014**
- Birational Geometry and Foliations workshop – Hausdorff Research Institute for Mathematics **February 2014**
- Queens University, algebraic geometry seminar **March 2014**
- University of South Carolina, colloquium **March 2014**

*Talks are continued on the next page.*

SELECTED TALKS	• Texas Algebraic Geometry Symposium (TAGS)	<b>March 2014</b>
CONTINUED	• George Mason University, colloquium	<b>April 2014</b>
	• George Mason University, combinatorics and algebra seminar	<b>April 2014</b>
	• Penn State University, algebra and number theory seminar	<b>April 2014</b>
	• Introduction to Cartier modules (3 lectures), Special Month on “Birational Geometry and Singularities in Zero and Positive Characteristic” held at the University of Michigan.	<b>June 2014</b>
	• Research presentation, Special Month on “Birational Geometry and Singularities in Zero and Positive Characteristic” held at the University of Michigan.	<b>June 2014</b>
	• University of Utah, algebraic geometry seminar	<b>September 2014</b>
	• Route 81 conference – Cornell University	<b>September 2014</b>
	• Western algebraic geometry seminar (WAGS conference) – University of Idaho	<b>October 2014</b>
	• Georgia algebraic geometry symposium (GAGS conference) – University of Georgia	<b>October 2014</b>
	• Georgia Tech, algebra seminar	<b>October 2014</b>
	• University of Michigan, algebraic geometry seminar	<b>January 2015</b>
	• Georgetown University AMS Meeting, Special Session on Closure Operations in Commutative Algebra	<b>March 2015</b>
	• Conference on Frobenius Operators and Cartier Algebras – Georgia State University	<b>March 2015</b>
	• AMS summer institute in Algebraic Geometry – University of Utah	<b>July 2015</b>
	• Mini-course at the Multiplier ideals, Test ideals and Bernstein-Sato polynomials, conference – Universitat Politcnica de Catalunya, Barcelona	<b>September 2015</b>
	• Joint mathematical meetings in Seattle, special session on commutative algebra,	<b>January 2016</b>
	• University of Illinois at Chicago, algebraic geometry seminar	<b>April 2016</b>
	• Differential forms in algebraic geometry (conference) – University of Freiburg, Germany	<b>September 2016</b>
	• KUMUNU – regional commutative algebra conference	<b>October 2016</b>
	• Nihon University Singularities Seminar	<b>November 2016</b>
	• University of Tokyo Algebraic Geometry Seminar	<b>November 2016</b>
	• SLAM (Southwest Local Algebra Meeting) – University of New Mexico	<b>March 2017</b>
	• AGNES (Algebraic Geometry Northeastern Series) – Stony Brook University	<b>April 2017</b>
	• London Geometry and Topology Seminar	<b>May 2017</b>
	• Higher Dimensional Algebraic Geometry 2017, Taipei, Taiwan	<b>June 2017</b>
UPCOMING TALKS	• The Prospects for Commutative Algebra, Osaka, Japan	<b>July 2017</b>
	• University of North Texas AMS Meeting, Special Session on Commutative Algebra, Denton, Texas	<b>September 2017</b>
	• Lecture series, Derived Algebraic Geometry and Birational Geometry and Moduli Spaces – MSRI, Berkeley, CA	<b>January 2019</b>