

# Michael DiPasquale

CONTACT INFORMATION	Colorado State University Department of Mathematics 1874 Campus Delivery Fort Collins, CO 80523	Mobile: 217-552-7673 E-mail: <a href="mailto:michael.dipasquale@colostate.edu">michael.dipasquale@colostate.edu</a> WWW: <a href="http://midipasq.github.io">http://midipasq.github.io</a>
RESEARCH INTERESTS	Computational commutative algebra and algebraic geometry. Emphasis on pure and applied problems which can be approached with the tools of algebraic geometry and commutative algebra.	
EDUCATION	<b>University of Illinois Urbana-Champaign</b> (UIUC), Urbana, IL Ph.D., Mathematics, May 2015 Advisor: Professor Hal Schenck Thesis: Splines on polytopal complexes <b>Wheaton College</b> , Wheaton, IL B.S., Mathematics, May 2009	
ACADEMIC APPOINTMENTS	<b>University of South Alabama</b> (USA), Mobile, AL Assistant Professor <b>Colorado State University</b> (CSU), Fort Collins, CO Postdoctoral Fellow <b>Oklahoma State University</b> (OSU), Stillwater, OK Visiting Assistant Professor	August 2021 - August 2018 - July 2021 August 2015 - May 2018
PUBLICATIONS	<ol style="list-style-type: none"><li>21. <i>On resurgence via asymptotic resurgence</i> (with B. Drabkin), accepted pending minor revision in J. Algebra. (2021) <a href="#">arXiv:2003.06980</a></li><li>20. <i>A homological characterization for freeness of multi-arrangements</i>, accepted pending minor revision in Math. Ann. (2021). <a href="#">arXiv:1806.05295</a></li><li>19. <i>Koszul multi-Rees algebras of principal L-Borel Ideals</i> (with B. Jabbar Nezhad), to appear in J. Algebra. (2021) <a href="#">arXiv:2008.09565</a></li><li>18. <i>A lower bound for splines on tetrahedral vertex stars</i> (with N. Villamizar), to appear in SIAM J. Appl. Algebra Geom. (2021) <a href="#">arXiv:2005.13043</a></li><li>17. <i>Counting the dimension of splines of mixed smoothness: A general recipe, and its application to meshes of arbitrary topologies.</i> (with D. Toshniwal), Adv. Comput. Math. (2021) doi:<a href="#">10.1007/s10444-020-09830-x</a>. <a href="#">arXiv:2001.01774</a></li><li>16. <i>On the apolar algebra of a product of linear forms</i> (with Z. Flores and C. Peterson). In <i>Proceedings of the 45th International Symposium on Symbolic and Algebraic Computation</i>, IS-SAC '20, pages 130-137, New York, NY, USA, 2020. Association for Computing Machinery, doi:<a href="#">10.1145/3373207.3404014</a>. <a href="#">arXiv:2002.04818</a></li><li>15. <i>A Generalization of Wilf's Conjecture for Generalized Numerical Semigroups</i> (with C. Cisto, G. Failla, Z. Flores, C. Peterson, and R. Utano), Semigroup Forum 101 (2020). <a href="#">arXiv:1909.13120</a></li><li>14. <i>Bivariate Semialgebraic Splines</i> (with F. Sottile), J. Approx. Theory 254 (2020), 105392, 19 pp. <a href="#">arXiv:1905.08438</a></li><li>13. <i>Free and non-free multiplicities on the <math>A_3</math> arrangement</i> (with C. Francisco, J. Mermin, and J. Schweig), J. Algebra 544 (2020), 498-532. <a href="#">arXiv:1609.00337</a></li><li>12. <i>Asymptotic resurgence via integral closures</i> (with C. Francisco, J. Mermin, and J. Schweig), Trans. Amer. Math. Soc. 372 (2019), no. 9, 6655-6676. <a href="#">arXiv:1808.01547</a></li><li>11. <i>The Rees algebra of a two-Borel ideal is Koszul</i> (with C. Francisco, J. Mermin, J. Schweig, and G. Sosa), Proc. Amer. Math. Soc. 147 (2019), no. 2, 467-479. <a href="#">arXiv:1706.07462</a></li><li>10. <i>Free multiplicities on the moduli of <math>X_3</math></i> (with M. Wakefield), J. Pure Appl. Algebra 222 (2018), no. 11, 3345-3359. <a href="#">arXiv:1707.03961</a></li><li>9. <i>Inequalities for free multi-braid arrangements</i>, Proc. Japan Acad. Ser. A Math. Sci. 94 (2018), no. 4, 36-41. <a href="#">arXiv:1705.02409</a></li></ol>	

8. *Dimension of mixed splines on polytopal cells*, Math. Comp. 87 (2018), no. 310, 905-939. [arXiv:1411.2176](#)
7. *Semialgebraic splines* (with F. Sottile and L. Sun), Comput. Aided Geom. Design 55 (2017), 26-47. [arXiv:1604.05947](#)
6. *Generalized splines and graphic arrangements*, J. Algebraic Combin. (2016), 1-19. [arXiv:1606.03091](#)
5. *Associated primes of spline complexes*, J. Symb. Comput. (2016), 158-199. [arXiv:1410.6894](#)
4. *Lattice-supported splines on polytopal complexes*, Adv. in Appl. Math. 55 (2014), 1-21. [arXiv:1312.3294](#)
3. *Shellability and freeness of continuous splines*, J. Pure Appl. Algebra. 216 (2012), 2519-2523.
2. *Asymptotic connectivity of hyperbolic planar graphs* (with P. Bahls), Discrete Math. 310 (2010), 3462-3472.
1. *On the order of a group containing nontrivial Gassmann equivalent subgroups*, Rose-Hulman Undergraduate Mathematics Journal 10, Issue 1 (2009).
0. *Splines on polytopal complexes*. Thesis (Ph.D.) University of Illinois at Urbana-Champaign (2015). 148 pp. ISBN: 978-1339-32551-4, ProQuest LLC.

UNDER REVIEW      1. *A lower bound for the dimension of tetrahedral splines in large degree* (with N. Villamizar), submitted. [arXiv:2007.12274](#)

GRANTS              AMS-Simons travel grant (2015-2018)  
\$4,000 for three years to support collaborative research

DISSEMINATION OF RESEARCH      Lead co-author of the package [AlgebraicSplines](#) for the computer algebra system Macaulay2. This package is currently used by several researchers, including Julianna Tymoczko, who employs this package in research with undergraduates at Smith College.

MENTORING              **Assistant** for a minicourse on [Algebraic Geometry at SMI](#) in Perugia              Summer 2019  
*Created problem sets and ran Macaulay2 help sessions twice per week.*  
**Honors option** for Intro to Math Reasoning and Linear Algebra              Fall 2019, Fall 2020  
*Created additional problem sets and problem sessions for students to receive honors credit.*  
**Mentor** in the [Illinois Geometry Lab](#)              Spring 2014, Fall 2014  
*Co-led undergraduate research on minimal energy configurations of particles.*  
**Teaching mentor** for junior graduate students              Fall 2013  
*Mentored several first-year graduate students, visited classes and offered teaching feedback.*

TEACHING EXPERIENCE      **Instructor of record**

Course	Description
Intro to Abstract Algebra (CSU)	group theory and proof writing
Intro to Math Reasoning (CSU)	proof writing
Linear Algebra (3 semesters, CSU)	matrix theory
Intro to Combinatorial Theory (CSU)	combinatorics and number theory
Calculus 2 (CSU)	sequences, series, and integration techniques
Intro to Real Analysis (OSU)	proof writing and real analysis
Calculus 1 (5 semesters, OSU)	differential and integral calculus
A Mathematical World (UIUC)	survey course emphasizing applications of mathematics
College Algebra (UIUC)	calculus preparation course
<ul style="list-style-type: none"> <li>- Responsible for lecturing, grading exams and quizzes, writing worksheets and homework</li> <li>- Wrote exams (except in Calculus 1 and 2)</li> <li>- Often implemented group work once per week</li> </ul>	

**Recitation instructor**, University of Illinois Urbana-Champaign

- Led bi-weekly 50-minute problem sessions and proctored and graded quizzes and exams for seven semesters of Calculus (1,2, and 3)
- Led student groups through worksheets I had written during bi-weekly two-hour workshops for one semester of Calculus 1 in the Merit program
- Appeared on the ‘List of Teachers Ranked as Excellent’ by their students in three semesters

**Undergraduate teaching assistant**, Wheaton College

- Led problem sessions once per week at Wheaton College for Analysis I, Algebra I, and Discrete Mathematics

CONFERENCE  
PRESENTATIONS

1. *Koszul multi-Rees algebras arising from principal Borel ideals* 03/2021  
AMS Sectional Meeting, Providence, RI (virtual due to COVID-19)  
*Special Session on Current Trends in Combinatorial Commutative Algebra*
2. *Dual sequences arising from apolarity* 03/2021  
AMS Sectional Meeting, Atlanta, GA (virtual due to COVID-19)  
*Special Session on Commutative Algebra and its Interaction with Algebraic Geometry and Combinatorics*
3. *Formal line arrangements and rigid planar frameworks* 01/2021  
Mathematisches Forschungsinstitut Oberwolfach, Germany (virtual due to COVID-19)  
*Workshop on Logarithmic Vector Fields and Freeness of Divisors and Arrangements*
4. *Regularity of uniform power ideals and the Waldschmidt constant* 10/2020  
AMS Sectional Meeting, University Park, PA (virtual due to COVID-19)  
*Special Session on Commutative Algebra and Connections to Algebraic Geometry and Combinatorics*
5. *On the apolar algebra of a product of linear forms* 07/2020  
The 45th International Symposium on Symbolic and Algebraic Computation, ISSAC ‘20 (virtual due to COVID-19)
6. **(Cancelled due to COVID-19)** *Generalizing Wilf’s conjecture to higher dimensions* 05/2020  
AMS Sectional Meeting, Fresno, CA  
*Special Session on Numerical Semigroups and Applications*
7. **(Cancelled due to COVID-19)** *A linear bound on the regularity of power ideals* 04/2020  
AMS Sectional Meeting, West Lafayette, IN  
*Special Session on Combinatorial Techniques in Commutative Algebra*
8. *A generalization of Wilf’s Conjecture* 01/2020  
AMS-MAA Joint Mathematics Meetings, Denver, CO  
*AMS Special Session on Recent Trends in Semigroup Theory*
9. *Apolarity and trivariate piecewise polynomials* 08/2019  
Algebraic Spline Geometry Meeting, Swansea, United Kingdom
10. *Algebraic Approaches to Spline Theory* 07/2019  
SIAM Conference on Applied Algebraic Geometry, Bern, Switzerland  
*Minisymposium on Multivariate Spline Approximation and Algebraic Geometry*
11. *Asymptotic Resurgence via Integral Closure and Linear Programs* 02/2019  
Southwest Local Algebra Meeting, El Paso, TX
12. *Asymptotic Resurgence and Integral Closures* 11/2018  
AMS Sectional Meeting, Fayetteville, AR  
*Special Session on Interactions Between Combinatorics and Commutative Algebra*
13. *Freeness of Multi-arrangements via Acyclicity* 06/2018  
Research Institute for Mathematical Sciences (RIMS), Kyoto, Japan  
*Matroids, reflection groups, and free hyperplane arrangements*
14. *A Homological Approach to Freeness of Multi-arrangements* 04/2018  
AMS Sectional Meeting, Boston, MA  
*Special Session on Arrangements of Hypersurfaces*

15. *The Toric Ring of a Two-Borel ideal is Koszul* 01/2018  
AMS-MAA Joint Mathematics Meetings, San Diego, CA  
*AMS Special Session on Combinatorial Commutative Algebra and Polytopes*
16. *Freeness of Multi-Coxeter Arrangements of type A* 09/2017  
AMS Sectional Meeting, Denton, TX  
*Special Session on Algebraic Combinatorics of Flag Varieties*
17. *Splines on planar semi-algebraic partitions* 09/2017  
AMS Sectional Meeting, Denton, TX  
*Special Session on Applicable and Computational Algebraic Geometry*
18. *Algebraic Methods in Spline Theory* 08/2017  
SIAM Conference on Applied Algebraic Geometry, Atlanta, GA  
*Minisymposium on Multivariate Splines and Algebraic Geometry*
19. *Multi-derivations on the moduli of the  $X_3$  arrangement* 04/2017  
AMS Sectional Meeting, Pullman, WA  
*Special Session on Combinatorial and Computational Commutative Algebra and Algebraic Geometry*
20. *Splines on Tetrahedral Decompositions* 05/2016  
15th International Conference on Approximation Theory, San Antonio, TX  
*Minisymposium on Approximation Theory and Algebraic Geometry*
21. *Generalized Splines and Graphic Multi-Arrangements* 10/2015  
AMS Sectional Meeting, Chicago, IL  
*Special Session on Combinatorial and Computational Algebra*
22. *Piecewise Polynomials and Regularity* 04/2015  
Mathematisches Forschungsinstitut Oberwolfach, Germany  
*Workshop on Multivariate Splines and Algebraic Geometry*
23. *Castelnuovo-Mumford Regularity of Mixed Spline Spaces* 01/2015  
AMS-MAA Joint Mathematics Meetings, San Antonio, TX  
*Session on Commutative Algebra*
24. *Regularity of Planar Splines* 04/2014  
AMS Sectional Meeting, Lubbock, TX  
*Special Session on Commutative Algebra and Algebraic Geometry*
25. *Regularity and Piecewise Polynomial Functions* 04/2014  
KUMUNU jr, Lincoln, NE
26. *Local Properties of Splines* 03/2014  
Southwest Local Algebra Meeting, College Station, TX  
*Graduate Student Poster Session*
27. *Lattice-Supported Splines on Polytopal Complexes* 01/2014  
AMS-MAA Joint Mathematics Meetings, Baltimore, MD  
*AMS Special Session on Hyperplane Arrangements and Applications*
28. *Lattice-Supported Bases for Polyhedral Splines* 08/2013  
SIAM Conference on Applied Algebraic Geometry, Fort Collins, CO  
*Session on Approximation Theory, Geometric Modeling, and Algebraic Geometry*
29. *Bivariate Continuous Splines on Polyhedral Complexes* 04/2013  
14th International Conference on Approximation Theory, San Antonio, TX  
*Minisymposium on Multivariate Splines*
30. *Shellability and Freeness of Continuous Splines* 10/2012  
AMS Sectional Meeting, Tulane, LA  
*Special Session on Approximation Theory, Geometric Modelling, and Algebraic Geometry*
31. *Exploring Gassmann Triples* 01/2009  
AMS-MAA Joint Mathematics Meetings  
*Undergraduate Student Poster Session (\$100 prize)*

SEMINAR &  
COLLOQUIUM  
TALKS

1. *Wilf's conjecture and its extensions* 11/2020  
Graduate Seminar, Towson University, Towson, MD (virtual due to COVID-19)
2. *Resurgence via Asymptotic Resurgence* 08/2020  
Algebra and Geometry Seminar, Iowa State University, Ames, IA. (virtual due to COVID-19)
3. *Extending Wilf's Conjecture* 10/2019  
Colloquium, University of North Carolina-Charlotte, Charlotte, NC
4. *Multi-derivations of hyperplane arrangements* 06/2019  
Mediterranea University of Reggio Calabria, Italy
5. *Combinatorics, topology, and algebra of hyperplane arrangements* 06/2019  
University of Messina, Italy
6. *Commutative Algebra and Piecewise Polynomials* 02/2018  
Colloquium, Marquette University, Milwaukee, WI
7. *Commutative Algebra and Approximation Theory* 01/2018  
Colloquium, University of Nebraska-Lincoln, Lincoln, NE
8. *Homological Obstructions to Freeness of Multi-Arrangements* 10/2017  
Geometry Seminar, Texas A&M University, College Station, TX
9. *Free Multi-Braid Arrangements and Resolutions* 03/2017  
Algebra Seminar, University of Arkansas, Fayetteville, AK
10. *Dimensions of Spline Spaces and Commutative Algebra* 11/2016  
Colloquium, Towson University, Towson, MD
11. *Two Tales of Freeness* 11/2016  
Colloquium, US Naval Academy, Annapolis, MD
12. *Multi-Derivations of Braid Arrangements* 09/2016  
Combinatorics Seminar, University of Kansas, Lawrence, KS
13. *Piecewise Polynomials and Algebraic Geometry* 04/2016  
Colloquium, University of Idaho, Moscow, ID
14. *Semialgebraic Splines* 03/2016  
Valley Geometry Seminar, University of Massachusetts, Amherst, MA
15. *Commutative Algebra meets Approximation Theory* 11/2015  
Numerical Analysis Seminar, Oklahoma State University, Stillwater, OK
16. *Commutative Algebra and Approximation Theory* 09/2015  
Colloquium, Oklahoma State University, Stillwater, OK
17. *Splines, Syzygies, and Freeness* 09/2015  
Algebra Seminar, Oklahoma State University, Stillwater, OK
18. *Regularity of Planar Splines* 09/2015  
Geometry Seminar, Texas A&M University, College Station, TX
19. *Algebraic Geometry and Approximation Theory* 02/2015  
Colloquium, University of South Florida, Tampa, FL
20. *Associated Primes of Complexes Arising in Approximation Theory* 11/2014  
Commutative Algebra Seminar, UIUC
21. *Castelnuovo-Mumford Regularity in Approximation Theory* 11/2014  
Algebraic Geometry Seminar, UIUC
22. *Lehmer's Picturesque Exponential Sums with a Twist (with Daniel Schultz)* 02/2010  
Number Theory Seminar, UIUC

TALKS FOR  
UNDERGRADUATE  
OR HIGH SCHOOL  
AUDIENCES

1. *Piecewise Linear Functions, Projecting Polytopes, and Equilibrium Stresses* 11/2018  
Symposium of Physics and Mathematics FCFM-IFM, Universidad Michoacana de San Nicolás de Hidalgo, Morelia, Michoacán, Mexico
2. *Explorations in Rigidity* 04/2018  
OSU Math Club, Oklahoma State University, Stillwater OK
3. *The Best Way to Divide up a Cheese* 10/2017  
High School Math Day, Oklahoma State University, Stillwater OK

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| 4. <i>The Pizza Cutting Problem</i>   | 02/2017 |
| Stillwater High School Math Seminar, Stillwater High School, Stillwater, OK |         |
| 5. <i>Counting Piecewise Linear Functions</i>                               | 03/2016 |
| Center for Women in Mathematics, Smith College, Northampton, MA             |         |
| 6. <i>Jumping Dimensions and Projecting Polytopes</i>                       | 12/2014 |
| Colloquium, Bradley University, Peoria, IL                                  |         |
| 7. <i>Continuous Piecewise Polynomials and Static Equilibrium</i>           | 10/2014 |
| Rose-Hulman Mathematics Seminar, Terra-Haute, IN                            |         |

PROFESSIONAL  
SERVICE

**Organizer**

Postdoc Seminar at CSU, Fall 2020, Spring 2021

**Co-organizer** (with Nelly Villamizar)

Minisymposium on Algebraic Methods for Multivariate Splines and Rigidity at the SIAM conference on Applied Algebraic Geometry in College Station, Texas, August 2021. (**Virtual due to COVID-19**)

**Co-organizer** (with Hendrik Speleers and Deepesh Toshniwal)

Minisymposium on Multivariate Splines: Theory and applications at the International Conference on Approximation Theory and Beyond, Nashville, TN, May 2020. (**Delayed due to COVID-19**)

**Co-organizer** (with Nelly Villamizar)

Minisymposium on Multivariate Spline Approximation and Algebraic Geometry at the SIAM conference on Applied Algebraic Geometry in Bern, Switzerland, July 2019.

**Co-organizer** (with Frank Sottile)

Minisymposium on Multivariate Splines and Algebraic Geometry at the SIAM conference on Applied Algebraic Geometry in Atlanta, GA, August 2017.

**Co-organizer** (with Tatyana Sorokina)

Minisymposium on Approximation Theory and Algebraic Geometry at the 15th International Conference on Approximation Theory in San Antonio, TX, May 2016.

**Organizer**

reading seminar on *The Geometry of Syzygies* in Fall 2011, Spring 2012

**Referee**

*Mathematische Annalen, Journal of Pure and Applied Algebra, International Journal of Algebra and Computation, Pacific Journal of Mathematics, Constructive Approximation, Computer-Aided Geometric Design, Journal of Algebraic Combinatorics, Graphs and Combinatorics, Proceedings of 15th International Conference on Approximation Theory*

**Reviewer**

Zentralblatt MATH, Mathematical Reviews

FUNDED AWARDS

**Bourgain Fellowship**, UIUC

Spring 2013

**REGS Summer Fellowships**, UIUC

Summer 2009-2013

**REU Summer Fellowships**, UNC Asheville & LSU

Summer 2008-2009

CONFERENCE-  
SPECIFIC  
GRANTS

**US Junior Oberwolfach Fellows grant**

01/2020

to attend MFO workshop in Oberwolfach, Germany (not used since the conference was virtual)

**SIAM Early Career Travel Award**

07/2019

to attend SIAM Conference on Applied Algebraic Geometry in Bern, Switzerland

**Supported Participant**

05/2017

at CMO Workshop on Symbolic and Ordinary Powers in Oaxaca, Mexico

**Oberwolfach Leibniz Graduate Students grant**

04/2015

to present at MFO workshop in Oberwolfach, Germany

**AMS Student Travel Grant**

04/2014

for presentation at AMS Sectional Meeting at Texas Tech

**AMS Student Travel Grant**

01/2014

for presentation at AMS-MAA Joint Mathematics Meetings

	<b>Student Travel Award</b>	08/2013
	to attend SIAM Conference on Applied Algebraic Geometry in Fort Collins, CO	
	<b>Travel Award</b>	04/2013
	for presentation at 14th International Conference on Approximation Theory	
	<b>Supported Participant</b>	12/2012
	at MSRI Workshop on Combinatorial Commutative Algebra	
	<b>AMS Student Travel Grant</b>	10/2012
	for presentation at the AMS Sectional Meeting at Tulane	
	<b>Supported Participant</b>	06-07/2012
	at IMA summer school in Applied Algebraic Geometry at Georgia Tech	
SELECTED WORKSHOPS ATTENDED	<b>MFO workshop</b> on Logarithmic Vector Fields and Freeness of Divisors	01/2021
	and Arrangements: New perspectives and applications	
	Oberwolfach, Germany	
	<b>Macaulay 2 workshop</b> on coding in the computer algebra system Macaulay2	07/2017
	Berkeley, CA	
	<b>CMO workshop</b> on Ordinary and Symbolic Powers of Ideals	05/2017
	Oaxaca, Mexico	
	<b>Macaulay2 workshop</b> on coding in the computer algebra system Macaulay2	05/2015
	Boise, ID	
	<b>MFO workshop</b> on Multivariate Splines and Algebraic Geometry	04/2015
PROFESSIONAL MEMBERSHIPS	Oberwolfach, Germany	
	<b>MSRI workshop</b> on Combinatorial Commutative Algebra	12/2012
	San Francisco, CA	
	<b>IMA summer school</b> in Applied Algebraic Geometry at Georgia Tech	06-07/2012
REFERENCES	Atlanta, GA	
	American Mathematical Society	
	Society for Industrial and Applied Mathematics	
	Member of activity group on applied algebraic geometry	
	Hal Schenck	Frank Sottile
	Auburn University	Texas A&M University
	hks0015@auburn.edu	sottile@math.tamu.edu
	Chris Peterson	Jess Ellis Hagman
	Colorado State University	Colorado State University
	peterson@math.colostate.edu	jess.ellis@colostate.edu
	Jeffrey Mermin	
	Oklahoma State University	
	mermin@math.okstate.edu	