

# Martin Helmer

Postdoctoral Fellow.

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## Summary of Mathematical Interests

My primary interest is to construct computational and theoretic tools to aid in understanding algebraic geometry and its applications. Broadly I am interested in algebraic geometry (theoretical, computational, and applied) and in related topics in computer algebra. I am particularly interested in practical methods in intersection theory, polynomial system solving and combinatorial algebraic geometry.

## Academic Positions

- 2017–Present **Postdoctoral Fellow**, *Department of Mathematical Sciences*, University of Copenhagen.
- Postdoc Mentor: Elisenda Feliu
- 2015–2017 **NSERC Postdoctoral Fellow and Visiting Assistant Professor**, *Department of Mathematics*, University of California, Berkeley.
- Postdoc Mentor: Bernd Sturmfels

## Publications

Martin Helmer and Bernd Sturmfels. Nearest Points on Toric Varieties. To appear in *Mathematica Scandinavica*, 2017.

Martin Helmer. Computing characteristic classes of subschemes of smooth toric varieties. *Journal of Algebra*, Volume 476, 2017, Pages 548-582, ISSN 0021-8693.

Martin Helmer (with Appendix by Martin Helmer and Éric Schost). A Direct Algorithm to Compute the Topological Euler Characteristic and Chern-Schwartz-MacPherson Class of Projective Complete Intersection Varieties. *Theoretical Computer Science*, Volume 681, 2017, Pages 54-74, ISSN 0304-3975.

Martin Helmer. Computing the Chern-Schwartz-MacPherson Class of Complete Simplicial Toric Varieties. *Springer Proceedings in Mathematics & Statistics book series (PROMS)*, volume 198 (ACA 2015), pp 207-217, July 2017.

Martin Helmer. Algorithms to compute the topological Euler characteristic, Chern-Schwartz-Macpherson class and Segre class of projective varieties. *Journal of Symbolic Computation*, 73, page 120-138, 2016.

Martin Helmer. An algorithm to compute certain Euler characteristics and Chern-Schwartz-MacPherson classes. Proceedings of the 2014 Symposium on Symbolic-Numeric Computation, pp. 130-131. ACM, 2014.

PL Bueno, Martin Helmer, and Jeroen SW Lamb. On the zero set of G-equivariant maps. *Mathematical Proceedings of the Cambridge Phil. Soc.*, volume 147, page 735. Cambridge Univ. Press, 2009.

Ramiro Liscano, John Khalil Jacoub, Anand Dersingh, Jinfu Zheng, Martin Helmer, Charles Elliott, and Ali Najafizadeh. Network performance of a wireless sensor network for temperature monitoring in vineyards. In Proceedings of the 8th ACM Symposium on Performance evaluation of wireless ad hoc, sensor, and ubiquitous networks, pp. 125-130. ACM, 2011.

## Submitted Preprints

Michael F Adamer, Martin Helmer. Euclidean Distance Degree for Chemical Reaction Networks (2017). arXiv preprint [arXiv:1707.07650](https://arxiv.org/abs/1707.07650).

Carlos Améndola, Nathan Bliss, Isaac Burke, Courtney R. Gibbons, Martin Helmer, Serkan Hoşten, Evan D. Nash, Jose Israel Rodriguez, Daniel Smolkin. The Maximum Likelihood Degree of Toric Varieties. (2017). arXiv preprint arXiv:1703.02251.

James Fullwood and Martin Helmer. On a projective bundle formula. (2016). arXiv preprint arXiv:1603.03553.

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## Education

- 2011–2015 **Ph.D Applied Mathematics**, *University of Western Ontario*, Canada.
  - Advisor: Éric Schost
- 2009–2011 **M.Sc Mathematics**, *Queen's University*, Canada.
- 2005–2009 **B.Sc Applied Mathematics**, *University of Ontario Institute of Technology*, Canada.

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## Fellowships, Scholarships and Awards

- 2015–2017 **NSERC (Natural Sciences and Engineering Research Council of Canada) Postdoctoral Fellowship**, University of California, Berkeley, USA.
- 2012–2013 **Ontario Graduate Scholarship**, University of Western Ontario, Canada.
- 2011–2012 **Ontario Graduate Scholarship**, University of Western Ontario, Canada.
- 2010–2011 **Ontario Graduate Scholarship**, Queen's University, Canada.
- 2009–2010 **Ontario Graduate Scholarship**, Queen's University, Canada.
- 2008 **NSERC USRA**, University of Ontario Institute of Technology, Canada.
- 2007 **UOIT STAR Award**, University of Ontario Institute of Technology, Canada.

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## Software

- 2016 **EDPolytope**, a Macaulay2 software package to compute the Euclidean distance degree and polar degrees of a projective toric variety using combinatorial methods.  
<https://math.berkeley.edu/~mhelmer/Software/toricED>
- 2015 **CharacteristicClasses**, with *Christine Jost*, a Macaulay2 built-in software package. Computes the Segre class, Chern-Schwartz-MacPherson class and Euler characteristic of a given subscheme of certain smooth toric varieties.  
<http://www.math.uiuc.edu/Macaulay2/doc/Macaulay2-1.9.2/share/doc/Macaulay2/CharacteristicClasses/html/>
- 2014 **char-class-calc**, a Sage program to compute the Segre class, Chern-Schwartz-MacPherson class and Euler characteristic of a projective variety.  
<https://github.com/Martin-Helmer/char-class-calc>

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## Teaching Experience (Instructor)

- 2016–2017 **Visiting Assistant Professor**.  
**Department of Mathematics, University of California, Berkeley.**
  - Spring Semester 2017:
    - Math 113: Introduction to Abstract Algebra
      - Course Homepage: [https://math.berkeley.edu/~mhelmer/Teaching/math113\\_2017](https://math.berkeley.edu/~mhelmer/Teaching/math113_2017)
  - Fall Semester 2016:
    - Math 143: Elementary Algebraic Geometry
      - Course Homepage: <https://math.berkeley.edu/~mhelmer/Teaching/math143>
  - Spring Semester 2016:
    - Math 113: Introduction to Abstract Algebra
      - Course Homepage: <https://math.berkeley.edu/~mhelmer/Teaching/math113>

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## Conference Talks

- Aug 3, 2017 **SIAM Conference on Applied Algebraic Geometry**, *Atlanta, USA*.  
Nearest Points on Toric Varieties
- Jan 5, 2017 **Joint Math Meetings: Algebraic Statistics Special Session**, *Atlanta, USA*.  
Topological Invariants and the Maximum Likelihood Degree of a Toric Variety
- Dec 7, 2015 **Fields Institute Thematic Program on Computer Algebra: Workshop on Algebra, Geometry and Proofs in Symbolic Computation**, *Toronto, Canada*.  
Algorithms to Compute Characteristic Classes of Subschemes of Certain Toric Varieties
- Aug 3, 2015 **SIAM Conference on Applied Algebraic Geometry**, *Daejeon, South Korea*.  
Algorithms for the Computation of Chern-Schwartz-MacPherson Classes and the Euler Characteristic
- July 22, 2015 **Applications of Computer Algebra Conference (ACA) 2015**, *Kalamata, Greece*.  
Algorithms to Compute Chern-Schwartz-Macpherson and Segre Classes and the Euler Characteristic
- July 30, 2014 **Symbolic-Numeric Computation Conference (SNC) 2014**, *Shanghai, China*.  
An Algorithm to Compute Certain Euler Characteristics and Chern-Schwartz-MacPherson Classes
- July 9, 2014 **Applications of Computer Algebra Conference (ACA) 2014**, *Bronx, New York, USA*.  
Algorithms to Compute Chern-Schwartz-Macpherson and Segre Classes and the Euler Characteristic

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## Seminar Talks

- Jan 13, 2017 **Algebra and Number Theory seminar**, *University of California, Santa Cruz*.  
Nearest Points on Toric Varieties
- Sept 28, 2016 **Algebra, Geometry, and Number Theory seminar**, *University of Saskatchewan, Saskatoon*.  
Nearest Points on Toric Varieties
- Feb 24, 2016 **Algebraic Statistics Seminar**, *Illinois Institute of Technology, Chicago*.  
Finding Nearest Points on Toric Varieties
- Feb 24, 2016 **Algebraic Geometry Seminar**, *University of Chicago*.  
Algorithms to Compute Characteristic Classes of Subschemes of Certain Toric Varieties
- Nov 27, 2015 **Geometry Seminar**, *University of Hong Kong*.  
Algorithms to Compute Characteristic Classes of Subschemes of Certain Toric Varieties
- Nov 18, 2015 **Algebra-Geometry-Combinatorics Seminar**, *San Francisco State University*.  
Algorithms to Compute Characteristic Classes of Subschemes of Certain Toric Varieties
- Nov 10, 2015 **Commutative Algebra and Algebraic Geometry Seminar**, *University of California, Berkeley*.  
Algorithms to Compute Chern-Schwartz-Macpherson Classes
- Sept 21, 2015 **Applied Algebra Seminar**, *University of California, Berkeley*.  
Algorithms to Compute Topological Invariants of Subschemes of Smooth Toric Varieties
- Mar 16, 2015 **Geometry and Topology Seminar**, *University of Western Ontario*.  
Algorithms to Compute Chern-Schwartz-Macpherson and Segre Classes and the Euler Characteristic
- Feb 9, 2015 **Queen's Algebraic Geometry Seminar**, *Queen's University, Kingston*.  
Algorithms to Compute Chern-Schwartz-Macpherson Classes
- June 27, 2014 **LIP6 - Université Paris 6, PolSys Seminar**, *Université Pierre-et-Marie-Curie, Paris*.  
Algorithms to Compute Chern-Schwartz-Macpherson and Segre Classes and the Euler Characteristic

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## Service

- 2016–2017 **Co-organizer**, with *Corey Harris*, Minisymposium on Euclidean Distance Degree.  
2017 SIAM Conference on Applied Algebraic Geometry, Atlanta, Georgia
- 2016 **Co-organizer**, with *David Dynerman*, Berkeley Applied Algebra Seminar.
- 2016 **Referee**, *Transactions of the AMS (American Mathematical Society)*.
- 2015 **Referee**, *Sixth International Conference on Mathematical Aspects of Computer and Information Sciences (MACIS)*.

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## Posters

April 26, 2014 **East Coast Computer Algebra Day (ECCAD) 2014**, *Duke University*, Durham.  
Algorithms to Compute Chern-Schwartz-Macpherson and Segre Classes and the Euler Characteristic

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## Other Teaching Experience

2012–2015 **Teaching Assistant.**

**Department of Applied Mathematics, University of Western Ontario.**

- Tutorials for AM2415: Applied Mathematical Methods for Electrical and Software Engineering I
- Tutorials for AM2413: Applied Mathematical and Numerical Methods for Mechanical Engineering
- Tutorials for AM1413: Applied Mathematics for Engineers I
- Tutorials for AM1411: Linear Algebra for Engineers

2011 **Math Education Researcher.**

**Department of Mathematics and Statistics, Queens University, Kingston, Canada.**

- Researched the effective use of electronic learning resources in the undergraduate calculus curriculum. Supervised by Peter Taylor.

2011 **Teaching Assistant.**

**Department of Mathematics and Statistics, Queens University, Kingston, Canada.**

- Tutorials for Math 224: Applied Mathematics for Civil Engineers