

Curriculum Vitae of Kiumars Kaveh

August 2020

1. GENERAL INFORMATION

University address: 301 Thackeray Hall, Department of Mathematics, University of Pittsburgh, Pittsburgh, PA, USA 15260

Email: kaveh@pitt.edu

Webpage: www.pitt.edu/~kaveh

Citizenship: Canada and Iran

2. POSITIONS

- Associate Professor, Department of Mathematics, University of Pittsburgh, Pittsburgh, PA, USA (since September 2015)
- Assistant Professor, Department of Mathematics, University of Pittsburgh, Pittsburgh, PA, USA (September 2010 until August 2015)
- Research Associate (Postdoctoral Fellow), Department of Mathematics and Statistics, McMaster University, Hamilton, ON, Canada (July 2009 to June 2010)
- CLTA Assistant Professor (Postdoctoral Fellow), Department of Mathematics, University of Toronto, Toronto, ON, Canada (July 2006 to June 2009)
- Postdoctoral Fellow, Department of Mathematics, University of British Columbia. Vancouver, B.C., Canada (September 2002 to December 2005)

3. RESEARCH INTERESTS

- Algebraic geometry, Lie theory and symplectic geometry; in particular: toric varieties, Newton-Okounkov bodies, flag varieties, spherical varieties, convex polytopes, equivariant cohomology, symplectic and Kähler geometry
- Side interests: (1) Cryptography, in particular Elliptic Curve Cryptography; (2) Quantum computing; (3) Algebraic number theory

4. EDUCATION

- Ph.D., Department of Mathematics, University of Toronto (May 2002). Advisor: Prof. A. G. Khovanskii. Thesis title: *Morse theory and Euler characteristic of sections of spherical varieties*
- Bachelor of Science (Mathematics), Department of Mathematical Sciences, Sharif University of Technology, Tehran, Iran (June 1996)
- Training camp for the International Olympiad in Informatics/Computer Science (Bonn, Germany) where I was a member of the Iranian team, Sharif University of Technology, Tehran, Iran (February to July 1992)
- High School Diploma, National Center for the Exceptional Talents, Tehran, Iran (June 1992)

5. RESEARCH ARTICLES AND PREPRINTS

Articles:

- (1) Kaveh, K.; Manon, C.; Murata, T. *Generic tropical initial ideals of Cohen-Macaulay algebras*. arXiv:2009.04928
- (2) Kaveh, K.; Khovanskii, A. G. *Intersections of hypersurfaces and ring of conditions of a spherical homogeneous space*. SIGMA Symmetry Integrability Geom. Methods Appl. 16 (2020), 016, 12 pages.
- (3) J. B. Carrell; Kaveh, K. *Momentum graphs, Chinese remainder theorem and the surjectivity of the restriction map*. arXiv:2004.03780
- (4) Escobar, L.; Kaveh, K. *Convex polytopes, algebraic geometry and combinatorics*. September 2020 issue of Notices of American Mathematical Society
- (5) Kaveh, K.; Villeda, E. *Cohomology ring of the flag variety vs Chow cohomology ring of the Gelfand-Zetlin toric variety*. Submitted to Annales de l'Institut Fourier. arXiv:1906.00154. 18 pages.
- (6) Kaveh, K.; Manon, C. *Toric bundles, valuations, and tropical geometry over semifield of piecewise linear functions*. arXiv: 1907.00543.
- (7) Kaveh, K.; Makhnatch, P. *Invariant factors as limit of singular values of a matrix*. arXiv:1811.07706, (undergraduate advisee project)
- (8) Kaveh, K.; Manon, C.; Murata, T. *On degenerations of projective varieties to complexity-one T -varieties*. arXiv:1708.02698. Submitted to Compositio Math. (March 2020)
- (9) Hamilton, M.; Harada, M.; Kaveh, K. *Convergence of polarizations, toric degenerations, and Newton-Okounkov bodies*. (27 pages). To appear in Communications in Analysis and Geometry
- (10) Kaveh, K.; Manon, C. *Khovanskii bases, higher rank valuations and tropical geometry*. (43 pages). SIAM J. Appl. Algebra Geom. 3 (2019), no. 2, 292–336.
- (11) Kaveh, K. *Toric degenerations and symplectic geometry of smooth projective varieties*. (26 pages). J. London Math. Soc. (2) 99 (2019), no. 2, 377–402.
- (12) Kaveh, K.; Villeda, E. *On a notion of anticanonical class for families of convex polytopes*. arXiv:1802.06674.
- (13) Kaveh, K.; Manon, C. *Toric principal bundles, piecewise linear maps and buildings*. arXiv:1806.05613. To be submitted to Math. Annalen.
- (14) Kaveh, K.; Manon, C. *Spherical tropical geometry: a survey of recent developments*. Acta Mathematica Sinica (Engl. Ser.) 34 (2018), no. 3, 454–465 (Sanya volume on spherical varieties)
- (15) Kaveh, K.; Khovanskii, A. G. *A short survey on Newton polytopes, tropical geometry and ring of conditions of algebraic torus*. (15 pages). arXiv:1803.07001
- (16) Kaveh, K.; Manon, C. *Gröbner theory and tropical geometry on spherical varieties*. (40 pages). Transform. Groups 24 (2019), no. 4, 1095–1145.
- (17) Kaveh, K.; A. G. Khovanskii *Complete intersections in spherical varieties*. Selecta Math. (N.S.) 22 (2016), no. 4, 2099–2141.
- (18) J. B. Carrell; Kaveh, K. *Springer fibers in the flag variety and the Weyl group action on equivariant cohomology*. (4 pages). Canadian Mathematical Bulletin 60 (2017), no. 3, 478–483.
- (19) Harada, M.; Kaveh, K. *Integrable systems, toric degenerations and Okounkov bodies*. Inventiones Mathematicae 202 (2015), no. 3, 927–985.
- (20) Kaveh, K. *Crystal bases and Newton-Okounkov bodies*. Duke Mathematical Journal 164 (2015), no. 13, 2461–2506.

- (21) Kaveh, K. *A remark on asymptotic enumeration of highest weights in tensor powers of a representation*. Bulletin of Iranian Mathematical Society 41 (2015), no. 3, 639–646.
- (22) Kaveh, K.; A. G. Khovanskii *On mixed multiplicities of ideals*. (20 pages). arXiv:1310.7979.
- (23) Kaveh, K.; A. G. Khovanskii *Convex bodies and multiplicities of ideals*. Proceedings of the Steklov Institute of Mathematics 286 (2014), no. 1, 268–284.
- (24) Kaveh, K.; A. G. Khovanskii *Grothendieck group of subspaces of rational functions and Shokurov's b -divisors*. Canadian Mathematical Bulletin 57 (2014), no. 3, 562–572.
- (25) Kaveh, K.; Khovanskii, A. G. *Newton-Okounkov bodies, semigroups of integral points, graded algebras and intersection theory*. Annals of Mathematics 176 (2012), 1–54.
- (26) Kaveh, K.; Khovanskii, A. G. *Convex bodies associated to actions of reductive groups*. Moscow Mathematical Journal, 12 (2012) no. 2., 369–396, 461.
- (27) Kaveh, K.; Khovanskii, A.G. *Algebraic equations and convex bodies*. Perspectives in analysis, geometry, and topology, 263–282, Progr. Math., 296, Birkhäuser/Springer, New York, 2012.
- (28) Kaveh, K. *Note on cohomology rings of spherical varieties and volume polynomial*. Journal of Lie Theory 21 (2011), No. 2, 263–283.
- (29) Kaveh, K.; Khovanskii, A. G. *Newton polytopes for horospherical varieties*. Moscow Mathematical Journal, 11 (2011), no. 2, 265–283.
- (30) Kaveh, K.; Khovanskii, A. G. *Moment polytopes, semigroup of representations and Kazarnovskii's theorem*. Journal of fixed point theory and applications Vol. 7 (2010), Number 2, 401–417.
- (31) Kaveh, K.; Khovanskii, A. G. *Mixed volume and an extension of intersection theory of divisors*. Moscow Mathematical Journal 10 (2010), no. 2, 343–375.
- (32) Carrell, J. B.; Kaveh, K. *On the equivariant cohomology of subvarieties of a \mathfrak{B} -regular variety*. Transformation Groups 13 (2008), no. 3-4, 495–505 (Volume in honor of Bertram Kostant).
- (33) Kaveh, K.; Khovanskii, A. G. *Convex bodies and algebraic equations on affine varieties*. (2008). arXiv:0804.4095. (44 pages).
- (34) Carrell, J. B.; Kaveh, K.; Puppe, V. *Vector fields, torus actions and equivariant cohomology*. Pacific Journal of Mathematics, Vol. 232 (2007), No. 1, 61–76.
- (35) Kaveh, K. *SAGBI bases and degeneration of spherical varieties to toric varieties*, Michigan Math. J. 53 (2005), No. 1, 109–121.
- (36) Kaveh, K. *Vector fields and cohomology rings of toric varieties*, Canadian Math. Bull. 48 (2005), No. 3, 414–427.
- (37) Guyot, C.; Kaveh, K.; Patankar, V. *Efficient algorithm for the arithmetic on the hyperelliptic Jacobians of genus 3*. Journal of Ramanujan Mathematical Society, 19 (2004), No. 2, 119–159.
- (38) Kaveh, K. *Morse theory and Euler characteristic of sections of spherical varieties*. Transformation Groups, Vol. 9 (2003), No. 1, 47–63.

Some work in progress:

- *Spherical logarithm map and K -orbits in spherical varieties*. With Victor Batyrev, Johannes Hofscheier and Megumi Harada (near completion)
- *A BKK theorem for toric vector bundles*. With Lingyu Liu (my Ph.D. student)
- *Positivity of tensor powers of a toric vector bundle*. With Lingyu Liu and Chris Manon
- *On the combinatorics appearing in Arthur's trace formula*. With Mahdi Asgari

6. AWARDS

- Simons Foundation Collaboration Grants for Mathematicians, September 2020–August 2025, Award Number: 714052
- NSF grant DMS-1601303, PI, August 2016–July 2019
- Simons Fellows in Mathematics, September 2016–August 2017
- NSF grant DMS-120058, PI, August 2012–July 2015
- Simons Foundation Collaboration Grants for Mathematicians, September 2015–August 2016
- Simons Foundation Collaboration Grants for Mathematicians. July 2011–August 2012

7. STUDENTS

- Elise Villella (Ph.D.). Thesis: Gelfand-Zetlin polytopes and geometry of flag variety. Defended August 2019.
- Daniel Ehrmann (Ph.D.) Thesis: Khovanskii-Gröbner bases. Defended November 2019.
- Takuya Murata (Ph.D.), since 2012. Thesis project: Toric degenerations. Will defend April 2020.
- Lingyu Liu (Ph.D.), Thesis project about toric vector bundles. Since Fall 2019.
- Thesis committee member of Dongyu Wu (Ph.D. in progress), Priyadip Mondal (Ph.D. in progress), Jorge Cely (Ph.D.), Ian Martiny (Master).
- External examiner of Jeremy Lane (Ph.D.), University of Toronto, 2016.

8. VISITING POSITIONS

- Fields Research Fellow (Summer 2020, Toronto)

9. CONFERENCE ORGANIZATION

- Co-organizer of special session *Convexity in algebraic geometry and symplectic geometry*. CMS meeting (Toronto, Ontario), December 2019
- Co-organizer and lecturer of the Fields summer school *Geometry of algebraic group actions* at McMaster University. June 2018
- Co-organizer of special session *Convexity in algebraic geometry and representation theory*. AMS Central Spring Section Meeting. Ohio State University, March 2018
- Co-organizer of a special session *Combinatorial algebraic geometry*. Canadian Mathematical Society Meeting (Niagara Falls, Canada). December 3–4 (2016)
- Co-organizer of the workshop *Okounkov bodies and applications*. Mathematisches Forschungsinstitut Oberwolfach (Oberwolfach, Germany), May 25–31 (2014)
- Co-organizer of the workshop *Convex bodies and representation theory*. BIRS (Banff International Research Station, Banff, Canada), February 2–7, 2014
- Co-organizer of special session *Toric algebraic geometry and beyond*. AMS Central Fall Section Meeting, University of Akron (Akron, Ohio), October 20–21 (2012)
- Co-organizer of *Algebra and Geometry Conference*, Independent University of Moscow (Moscow, Russia), June 4–9 (2012)
- Co-organizer of the mini-workshop *New developments in Newton-Okounkov bodies*. Mathematisches Forschungsinstitut Oberwolfach (Oberwolfach, Germany), August 21–28 (2011)

10. SOME INVITED TALKS AND MINI-COURSES

- Mini-course on toric varieties, University of Nantes, France, May 2020 (CANCELLED)
- Toric Geometry seminar, Fields Institute (Toronto, Canada), March 2019
- Colloquium, University of Waterloo, November 2019
- Toric Geometry. Mathematisches Forschungsinstitut Oberwolfach (Oberwolfach, Germany), September (2019)
- Colloquium, University of Washington St. Louis, February 2019.
- Colloquium, Oklahoma State University, November 2018
- Colloquium, McGill University, January 2018
- Mini-course on toric varieties, Fields Institute summer school Geometry of algebraic groups actions, June 2018, McMaster University.
- University of Cologne, Algebra Seminar, July 2018 (Germany).
- Cornell-Penn State symplectic geometry workshop. March 2018
- Purdue University, Algebraic Geometry Seminar, 2018
- University of Michigan Algebraic Geometry Seminar, October 2017.
- Carleton-Ottawa Colloquium, Carleton University, Ottawa, December 2016
- Colloquium, University of Western Ontario. November 2016
- Convexity Workshop. Fields Institute. October 3–7, 2016
- Tapas course (part of Fields Institute thematic program on Combinatorial Algebraic Geometry) on Newton-Okounkov bodies, Khovanskii bases and tropical geometry. Fields Institute. September 2016
- Toric Geometry. Mathematisches Forschungsinstitut Oberwolfach (Oberwolfach, Germany), March 27 – April 2, 2016
- Colloquium, York University, November 2015
- Princeton Algebraic Geometry Seminar, Princeton University, October 27, 2015
- Geometric Invariant Theory workshop, Berlin, Germany, August 31– September 4, 2015.
- International Congress of Mathematicians, Satellite Conference on Topology of Torus Actions and its Applications to Geometry and Combinatorics. Daejeon, South Korea, August 7–11, 2014

- Colloquium, George Mason University, February 2014
- Colloquium, University of Illinois at Urbana-Champaign. September 2013
- Plenary speaker in 10th annual meeting of *Combinatorial Algebra meets Algebraic Combinatorics*. Fields Institute, Toronto, Canada. January 25–27, 2013
- Algebraic Geometry Seminar, University of Michigan at Ann Arbor, October 2012
- Toric Geometry. Mathematisches Forschungsinstitut Oberwolfach (Oberwolfach, Germany), April 15–21 (2012)
- Colloquium, University of Toronto. November 2011
- Geometry/Physics Seminar, Northwestern University, March 31, 2011
- BIRS Workshop on Topological Methods in Toric geometry, Symplectic Geometry and Combinatorics, Banff International Research Station, Banff, Canada, 8 –12 November 2010
- International Congress of Mathematicians Satellite Conference on Complex Geometry, Group actions and Moduli spaces, Hyderabad, India, August 19–27, 2010
- Workshop on Combinatorial, Enumerative and Toric Geometry, (in honor of 70th birthday of William Fulton), MSRI, Berkeley, California, March 23–27, 2009

11. OTHER PROFESSIONAL ACTIVITIES

- Reviewer for NSERC (National Science and Engineering Research Council), NSA (National Security Agency), Austrian Science Fund and Israel Foundation.
- Referee for: *Compositio Mathematica*, *Mathematical Research Letters*, *Duke Mathematical Journal*, *Journal of London Math. Society*, *Contributions to algebra and geometry*, *Journal of Algebraic Geometry*, *International Mathematics Research Notices*, *SIGMA*, *Journal of Australian Mathematical Society*, *Foundations of Computational Mathematics*, *Journal of Combinatorial Theory A*, *Electronic Research Announcement*, *Canadian Mathematical Bulletin*, *Canadian Mathematical Journal* and *Journal of Algebraic Combinatorics*.

12. EXTRA CURRICULAR ACTIVITIES

- I am interested in music especially Iranian (Persian) traditional music. I have been playing the instruments *tar*, *setar* and *tanboor* since 1994. These are guitar-type traditional Iranian instruments.
- I am also interested in comics and drawing cartoons as a hobby. Some of my comics have been published. I sometimes use my drawing skills during my teaching to make the atmosphere of the class more fun.
- I have a black belt in Karate (Kan-Zen-Rio), (1996).