Colleen Robles

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Education University of British Columbia, Mathematics Ph.D. 2003
University of Washington, M.S. 1998
Smith College, B.A. 1996

Employment Duke University,
  Professor, July 2020 – present.
  Associate Professor, July 2015 – June 2020.

  Texas A&M University,
  Associate Professor, Fall 2012 – June 2015.
  Assistant Professor, Fall 2006 – Summer 2012.

  University of Rochester,
  Visiting Assistant Professor, Fall 2003 – Spring 2006.

Visiting Positions

- FRIAS Senior Fellow and Marie Curie Fellow of the European Union, Freiburg Institute for Advanced Study, University of Freiburg, May – July 2022.
- Korea Institute for Advanced Study, Visiting Scholar, Jun 2019, May 2017, Apr 2016.
- Institute of Mathematics of the Polish Academy of Sciences, Senior Simons Professor, Nov 2017.
- Simons Center for Geometry and Physics, Visitor, Mar 2016.
- Institute for Advanced Study, Member, Fall 2013 – Spring 2014.
- University of Utah, Visiting Scholar, Fall 2012 – Spring 2013.

Grants (2013–present)

- NSF-DMS-2304981, *Complex Geometric Properties of Period Maps*, 2023–2026.
- NSF-DMS-1906352, *Complex Geometric and Lie Theoretic Aspects of Hodge Theory*, 2019–2023.
- NSF-DMS-1611939, *Complex Geometric and Lie Theoretic Aspects of Hodge Theory*, 2016–2019.
- NSF-DMS-1361120, *FRG: Collaborative Research: Hodge Theory, Moduli and Representation theory*, with P. Brosnan, M. Kerr, R. Laza & G. Pearlstein, 2014–2017.
- NSF-DMS-1309238, *Hodge Theory and Representation Theory*, 2013–2016.

Publications

[1] Pseudoconvexity at infinity in Hodge theory: a codimension one example, arXiv2302.04806.

[2] Extension of Hodge norms at infinity, arXiv:2302.04014.

[3] Natural line bundles on completions of period mappings (w/ M. Green & P. Griffiths), arXiv:2102.06310.

[4] Global asymptotic structure of period mappings (w/ M. Green & P. Griffiths), arXiv:2010.06720.

[5] The LLV decomposition of hyper-Kähler cohomology (w/ M. Green, Y.-J. Kim & R. Laza), *Math. Ann.* **382** (2022), no. 3-4, 1517–1590.

[6] Hodge Representations (w/ X. Han), *Experimental Results* **1** (2020), doi:10.1017/exp.2020.55.

[7] Period mappings and properties of the Hodge line bundle (w/ M. Green, P. Griffiths & R. Laza), arXiv:1708.09523.

[8] Polarized relations on horizontal SL(2)s (w/ G. Pearlstein & M. Kerr), *Doc. Math.* **24** (2019), 1295–1360.

[9] Characterization of Calabi–Yau variations of Hodge structure over tube domains by characteristic forms, *Math. Ann.* **371** (2018), no. 3–4, 1229–1253. doi:10.1007/s00208-017-1594-3.

[10] Degenerations of Hodge structure, The Graduate Student Bootcamp for the 2015 Algebraic Geometry Summer Research Institute, *Proc. Sympos. Pure Math.* **95** (2017), 267–283, AMS.

[11] Nilpotent cones and their representation theory, (w/ P. Brosnan & G. Pearlstein), in *Hodge theory and L^2-analysis*, ALM **39**, 2017.

[12] Hodge theory and real orbits in flag varieties, (w/ M. Kerr), *Adv. Math.* **315** (2017), 27–87.

[13] Classification of smooth horizontal Schubert varieties, (w/ M. Kerr), *European J. Math.* **3** (2017), no. 2, 289–310.

[14] Classification of horizontal SL_2's, *Compositio Math.* **152** (2016), no. 05, 918–954.

[15] Extremal degenerations of polarized Hodge structures (w/ M. Green & P. Griffiths), in *Hodge theory and L^2-analysis*, ALM **39**, 2017.

[16] Characteristic cohomology of the infinitesimal period relation, *Asian J. Math.* **20** (2016), no. 4, 725–758.

[17] Quotients of non-classical flag domains are not algebraic (w/ P. Griffiths & D. Toledo), *Algebraic Geometry* **1** (2014), 1–13.

[18] Flexibility of Schubert classes (w/ İ. Coşkun), *Differential Geom. Appl.* **31** (2013), no. 6, 759–774.

[19] Principal Hodge representations, Proceedings of the Conference on Hodge Theory Complex Geometry, and Representation Theory, *Contemporary Mathematics* **608** (2014), 259–283, AMS.

[20] Schubert varieties as variations of Hodge structure, *Selecta Math.*, **20** (2014), no. 3, 719–768.

[21] Singular loci of cominuscule Schubert varieties, *J. Pure Appl. Algebra*, **218** (2014), 745–759.

[22] Schur flexibility of cominuscule Schubert classes, *Comm. Anal. Geom.*, **21** (2013), no. 5, 979Ð-1013.

[23] Rigid Schubert varieties in compact Hermitian symmetric spaces (w/ D. The), *Selecta Math.* **18** (2012), no. 3, 717–777.

[24] Fubini-Griffiths-Harris rigidity of homogeneous varieties (w/ J.M. Landsberg), *Int. Math. Res. Not.*, **7** (2013), 1643-1664.

[25] Fubini-Griffiths-Harris rigidity and Lie algebra cohomology (w/ J.M. Landsberg) , *Asian J. Math.*, **16** (2012), no. 4, 561–588.

[26] Parallel calibrations and minimal submanifolds, *Illinois J. Math.* **56** (2012), no. 2, 383–395.

[27] Projective invariants of CR-hypersurfaces (w/ C. Hammond), *Complex Var. Elliptic Equ.* (2011).

[28] Lines and osculating lines of hypersurfaces (w/ J.M. Landsberg), *J. London Math. Soc.*, (2) **82** (2010), no. 3, 733–746.

[29] Calibrated embeddings in the associative and Cayley cases (w/ Sema Salur), *Asian J. Math.*, **13**, no. 3 (2009) 287–306.

[30] Fubini's theorem in codimension two (w/ J.M. Landsberg), *J. Reine Angew. Math.*, **631** (2009) 221–235.

[31] The adjoint variety of $\mathrm{SL}_m\mathbb{C}$ is rigid to order three, *Differential Geom. Appl.*, **26** (2008) 683–696.

[32] Geodesics in Randers spaces of constant curvature, *Trans AMS* **359** (2007), no. 4, 1633–1651.

[33] Ricci and flag curvatures in Finsler geometry (w/ D. Bao), in *A Sampler of Riemann–Finsler Geometry*, MSRI Series, vol. 50, 2004.

[34] Zermelo navigation on Riemannian manifolds (w/ D. Bao & Z. Shen), *J. Diff. Geom.*, 66 (2004) 391–449.

[35] On Randers metrics of constant flag curvature (w/ D. Bao), *Rep. Math. Phys.*, 51 (2003) 9–42.

Invited Talks (2018 – present – planned)

Public. National Museum of Mathematics, New York City, Sep 2023.

Short Courses and Lecture Series. Moduli, K-trivial Varieties and Related Topics (3 hrs), IBS Center for Complex Geometry, Daejeon, Feb 2024 • Representation Theory and Geometry, Paris (3 hrs), Jun 2022 • Recent Developments in Hodge Theory, IMSA (2 lec), Apr 2021 • ICERM (2 lec), Feb 2021 • CIRM (3 lec), Dec 2018

Conference. Twister theory, Isaac Newton Institute, Sep 2024 • Moduli, K-trivial Varieties and Related Topics, IBS Center for Complex Geometry, Daejeon, Feb 2024 • Representation theory and flag or quiver varieties, Paris, Jun 2022 • Classical Elegance: the Geometry of Algebraic Varieties, in honour of Rita Pardini's birthday, Cortona, Jun 2022 • Conference on the occasion of Claire Voisin's 60th birthday, Institut Henri Poincaré, May 2022 • Hodge Theory and Moduli, IMSA, Feb 2021 • Komplex Analysis: algebraicity and transcendence, Oberwolfach, Aug 2020 • Recent Advances in Mirror Symmetry, TSIMF, Dec 2019 • The Legacy of Élie Cartan, TSIMF, Dec 2019 • Discrete Groups and Moduli, Nagoya, Jun 2019 • Cartan Geometry, KIAS, May 2019 • Hodge Theory, Arithmetic and Moduli, PIMS, U British Columbia, May 2019 • Baltimore-Washington Metro Area Differential Geometry Seminar, Howard U, Apr 2019 • Women in Geometry Workshop, Rice U, Apr 2019 • New trends and open problems in Geometry and Global Analysis, Marburg, Aug 2018 • Modern Geometry, Miami, Mar 2018 • Simons Workshop on Homological Mirror Symmetry and Hodge Theory, Harvard, Jan 2018

Department Colloquium. U North Carolina, Apr 2023 • Southern Georgia U, Nov 2018 • Wichita State U, Feb 2018

Department Seminar. Lean, Rutgers, Nov 2023 • Algebraic & Arithmetic Geometry, Washington U, Oct 2023 • Oberseminar: Algebra, Zahlentheorie und algebraische Geometrie, Freiburg, Jun 2022 • Geometry, Stony Brook, Apr 2021 • Essener Seminar für Algebraische Geometrie und Arithmetik, Dec 2020 • Geometry, KTH Stockholm, Dec 2020 • Geometry, Brussels–Oxford–Warwick–London, Oct 2020 • Algebraic Geometry, Colorado U, Feb 2020 • Algebraic Geometry, Washington U, Sep 2019 • Algebraic Geometry, Pisa, Jun 2018

PhD Students

- Chongyao Chen
- Panchali Nag, *Differential Geometry Tools for Data Analysis*, PhD 2021 Duke U (co-advised with Ingrid Daubechies)
- Curtis Porter, *The Local Equivalence Problem for 7-Dimensional, 2-Nondegenerate CR Manifolds whose Cubic Form is of Conformal Unitary Type*, PhD 2016 Texas A&M U (co-advised with J.M. Landsberg & Igor Zelenko)

Undergraduate Students

- Xiayimei Han, *Hodge representation of Calabi-Yau 3-folds*, Duke U 2020

Mentoring

- Math+ Project Leader, *Automated Theorem Proving and Proof Verification*, Summer 2023. Undergraduate researchers: Yannan Bai, Annapurna Bhattacharya, Stavan Jain, Kurt Ma, Ricardo Prado Cunha, Anoushka Sinha
- Faculty Champion, Duke University Center of Exemplary Mentoring, 2017 - present https://ucem.duke.edu/
- Mentor, Duke SPIRE Fellow, 2017 - present https://spire.duke.edu/

Teaching

- Fall 2016 course evaluations among the top 5% of all undergraduate instructors in Trinity College for a small class in the categories of Quality of Course, Quality of Instruction, and Intellectual Stimulation.
- Math 212: Multivariable Calculus, Spring 2023.
- MATH 221: Linear Algebra, Fall 2015.
- MATH 281S: Problem Solving Seminar, Fall 2021 & 2023.
- MATH 401: Abstract Algebra, Fall 2018.
- MATH 603: Representation Theory, Fall 2020.
- MATH 620: Smooth Manifolds, Fall 2019 & 2021.
- MATH 621: Differential Geometry, Spring 2019.
- MATH 625: Riemann Surfaces, Fall 2016.
- MATH 627: Algebraic Geometry, Spring 2018.
- MATH 633: Complex Analysis, Spring 2017 and 2018.
- Math 690: Hodge Theory, Spring 2024
- MATH 790: Mini-course on Algebraic Surfaces, Spring 2017.
- MATH 790: Mini-course on Generalizations of the Satake-Baily-Borel Compactification, Fall 2017.
- MATH 790: Mini-course on Toric Geometry, Fall 2018.

Department Service

- Director of Graduate Studies, Jan 2019 - Jun 2022.
- Graduate Admissions Committee, 2016 - 2018.
- Gergen Lecture Series Committee, 2016 - 2018.

- Duke Mathematical Sciences Sabbatical Fellows Committee, Summer 2017 – present.
- Summer Workshop in Mathematics (SWIM) lecture, Jun 2017, 2018, 2019.
- Women In Math Lunches, organizer, 2016 - 2018.

University Service
- Provost's Ad Hoc Working Group on Guaranteed 12-months Funding for Duke PhD Students, Summer–Fall, 2021.
- Graduate Student Selection Committee for the 2018 Dean's Awards for Excellence in Mentoring, Fall 2017.

Editorial Boards   Differential Geometry and Its Applications, 2017–2022.

Conferences organized (2013–present)
- Duke Mathematical Journal, Duke, Apr 2018 (w/ R. Hain, L. Ng, J. Wahl).
- Hodge Theory, Moduli and Representation Theory, SCGP, Aug 2017 (w/ P. Brosnan, M. Kerr, R. Laza, G. Pearlstein).
- Flag Domains and Cycle Spaces, Korea Institute for Advanced Study, May 2017 (w/ J. Hong and S. Y. Kim).
- Algebraic Cycles and Moduli, CRM, Jun 2016 (w/ P. Brosnan, M. Kerr, M. Lalin, R. Laza, J. Lewis, G. Pearlstein).
- Focused Research Group on Hodge Theory, Moduli and Representation Theory: Workshop I, College Station, TX, Sep 2014 (w/ Greg Pearlstein).
- Texas Geometry and Topology Conference, College Station, TX, Oct 2013 (w/ J.M. Landsberg & Jon Pitts).
- New Directions in Exterior Differential Systems, a conference in honor of Robert Bryant's 60th birthday, Colorado, Jul 2013 (w/ Jeanne Clelland & J.M. Landsberg).