

Radu Laza

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Papers on arXiv: [R.Laza@arXiv](https://arxiv.org/a/laza_r)

Education

Ph.D. Mathematics, Columbia University, 2006.
Diplom Mathematics, University of Kaiserslautern, 2000.
B.S. Mathematics, University of Bucharest, 2000.

Employment

Professor, Stony Brook University, 2019–current.
Associate Professor, Stony Brook University, 2014–2018.
von Neumann Fellow, Institute for Advanced Study (IAS, Princeton, NJ), 2014–2015.
Assistant Professor, Stony Brook University, 2009–2014.
Postdoc Assistant Professor, University of Michigan, 2006–2009.
Postdoctoral Fellow, Mathematical Sciences Research Institute (MSRI), Jan–May 2009.

Academic Visits

Research Professor (invited) at Shanghai Center for Mathematical Sciences, Nov 2018.
École Normale Supérieure, AY 2016/17
Research Institute for Mathematical Sciences (RIMS), Jun–Jul 2013.
Institut des Hautes Études Scientifiques (IHES), Jun–Aug 2010.
Harvard University, May–Aug 2007, May–Aug 2008.
Nagoya University, February 2008.

Research Interests

Algebraic Geometry, Complex Geometry, and Arithmetic Geometry. In particular, the construction and geometry of moduli spaces, GIT, Hodge theory, singularities, special classes of algebraic varieties (Calabi-Yau and Hyperkähler manifolds, $K3$ surfaces), automorphic forms.

Publications

1. Cohomology of the moduli space of cubic threefolds and its smooth compactifications, (w. S. Casalaina-Martin, S. Grushevsky, K. Hulek), *Mem. Amer. Math. Soc.* 282 (2023), No. 1391.
2. Smoothing of rational singularities and Hodge structure, (w. M. Kerr and M. Saito), *Algebr. Geom.* 9 (4) (2022) 476–501.
3. The LLV decomposition of hyper-Kähler cohomology, (w. M. Green, YJ Kim, and C. Robles), *Math. Ann.* 382 (2022), no. 3-4, 1517-1590.
4. Automorphisms and periods of cubic fourfolds, (w. Z. Zheng), *Math. Z.* 300 (2022), no. 2, 1455–1507.
5. Hodge theory of degenerations, (I): Consequences of the decomposition theorem, (w. M. Kerr, and an Appendix by M. Saito), *Selecta Math.* 27 (2021), No. 4, Paper No. 71.
6. Maximally algebraic potentially irrational cubic fourfolds, *Proc. Amer. Math. Soc.* 149 (2021), no. 8, 3209-3220.
7. GIT vs Baily-Borel compactification for $K3$'s which are double covers of $\mathbb{P}^1 \times \mathbb{P}^1$, (with K. O'Grady), *Adv. Math.* 383 (2021), Paper No. 107680.
8. Complete moduli of cubic threefolds and their intermediate Jacobians, (w. S. Casalaina-Martin, S. Grushevsky, and K. Hulek), *Proc. Lond. Math. Soc.* 122 (2021), no. 2, 259-316.
9. A conjectural bound on the second Betti number for hyper-Kähler manifolds, (w. YJ Kim), *Bull. Soc. Math. France* 148 (2020), no. 3, 467-480.
10. The Euler number of hyper-Kähler manifolds of OG10 type, (w. K. Hulek and G. Saccà), in Proceedings of the ICM 2018 Satellite conference "Moduli Spaces in Algebraic Geometry and Applications", *Mat. Contemp.* 47 (2020), 151-170.
11. Birational geometry of the moduli space of quartic $K3$ surfaces, (w. K. O'Grady), *Compositio Math.* 155 (2019), no. 9, 1655-1710.
12. Remarks on degenerations of hyper-Kähler manifolds, (w. J. Kollár, G. Saccà, and C. Voisin), *Ann. Inst. Fourier (Grenoble)* 68 (2018), no. 7, 2837-2882.
13. On the moduli space of pairs consisting of a cubic threefold and a hyperplane, (w. G. Pearlstein and Z. Zhang), *Adv. Math.* 340 (2018), 684-722.
14. GIT versus Baily-Borel compactification for quartic $K3$ surfaces, (w. K. O'Grady), in *Geometry of Moduli (Abel Symposia)*, Springer, 2018, 217-283.
15. A hyper-Kähler compactification of the Intermediate Jacobian bundle associated to a cubic fourfold, (w. G. Saccà and C. Voisin), *Acta Math.* 218 (2017), no. 1, 55-135.
16. Extending the Prym map to toroidal compactifications of the Siegel space, (w. S. Casalaina-Martin, S. Grushevsky, and K. Hulek), *J. Eur. Math. Soc.* 19 (2017), no. 3, 659-723.
17. The KSBA compactification for the moduli space of degree two $K3$ pairs, *J. Eur. Math. Soc.* 18 (2016), no. 2, 225-279.
18. Classical period domains, (w. Z. Zhang), in *Recent Advances in Hodge Theory* (London Mathematical Society Lecture Note Series, 427), Cambridge Univ. Press, 2016, 3-44.
19. Perspectives on the construction and compactification of moduli spaces, in *Compactifying Moduli Spaces* (Advanced Courses in Mathematics, CRM Barcelona), Birkhäuser, 2016, 1-39.

20. On some Hermitian variations of Hodge structure of Calabi-Yau type with real multiplication (w. R. Friedman), *Michigan Math. J.* 63 (2014), no. 1, 83–99.
21. Log canonical models and variation of GIT for genus four canonical curves, (w. S. Casalaina-Martin, and D. Jensen), *J. Algebraic Geom.* 23 (2014), 727–764.
22. Semi-algebraic horizontal subvarieties of Calabi-Yau type (w. R. Friedman), *Duke Math. J.* 162 (2013), no. 12, 2077–2148.
23. GIT and moduli with a twist, in *Handbook of moduli* vol. II, Adv. Lect. Math. 25 (2013), Int. Press, 259–297 (invited contribution).
24. Simultaneous semi-stable reduction for curves with ADE singularities (w. S. Casalaina-Martin), *Trans. Amer. Math. Soc.* 365 (2013), no. 5, 2271–2295.
25. The geometry of the ball quotient model of the moduli space of genus four curves, (w. S. Casalaina-Martin, and D. Jensen), in *Compact Moduli Spaces and Vector Bundles* (Proceedings of the international conference held at University of Georgia, Athens, GA (Oct 21-24, 2010)), *Contemp. Math.* 564 (2012), 107–136.
26. The moduli space of cubic fourfolds via the period map, *Annals of Math.* 172 (2010), no. 1, 673–711.
27. The moduli space of cubic threefolds via degenerations of the intermediate Jacobian (w. S. Casalaina-Martin), *J. Reine Angew. Math.* 633 (2009), 26–65.
28. The moduli space of cubic fourfolds, *J. Algebraic Geom.* 18 (2009), 511–545.
29. Deformations of singularities and variations of GIT quotients, *Trans. Amer. Math. Soc.* 361 (2009), no. 4, 2109–2161.
30. Counting the hyperplane sections with fixed invariants of a plane quintic (w. C. Cadman), *Adv. Geom.* 8 (2008), 531–549.
31. Maximal Cohen-Macaulay modules over the cone of an elliptic curve (w. G. Pfister and D. Popescu), *Journal of Algebra* 253 (2002), no. 2, 209–236.
32. Maximal Cohen-Macaulay modules over $Y_1^3 + \dots + Y_n^3$ with few generators (w. L. O’Carroll and D. Popescu), *Math. Rep.* 3 (53)(2001), no. 2, 177–185.

Preprints

33. The higher Du Bois and higher rational properties for isolated singularities (w. R. Friedman), arXiv:2207.07566.
34. Higher Du Bois and higher rational singularities (w. R. Friedman, and appendix by M. Saito), arXiv:2205.04729.
35. Non-isomorphic smooth compactifications of the moduli space of cubic surfaces (w. S. Casalaina-Martin, S. Grushevsky, K. Hulek), arXiv:2207.03533.
36. Deformations of some local Calabi-Yau manifolds, (w. R. Friedman), arXiv:2203.11738.
37. Deformations of singular Fano and Calabi-Yau varieties, (w. R. Friedman), arXiv:2203.04823.
38. Hodge theory of degenerations, (II): Vanishing cohomology and geometric applications, (w. M. Kerr), arXiv:2006.03953.
39. Period mappings and ampleness of the Hodge bundle, (w. M. Green, P. Griffiths, and C. Robles), arXiv:1708.09523.
40. Triangulations of the sphere and degenerations of K_3 surfaces, unpublished preprint (arXiv:0809.0937), 2008.

Books Edited

41. Calabi-Yau Varieties: Arithmetic, Geometry and Physics: Lecture Notes on Concentrated Graduate Courses (w. Schuett and N. Yui), Fields Institute Monographs, 2015, Springer.
42. Arithmetic and Geometry of $K3$ Surfaces and Calabi-Yau Threefolds, (w. M. Schütt, and N. Yui), proceedings of the *Workshop on the geometry and arithmetic of Calabi-Yau varieties* (Fields Institute, Toronto, Aug. 2011), Fields Institute Communications, vol. 67, 2013, Springer.

Honors and Awards

- NSF grant DMS-2101640, PI (2021-2024).
- NSF grant DMS-1802128, PI (2018-2021).
- Chaire Junior (FSMP, 2016-17).
- Simons Fellow (2016-2017).
- NSF CAREER grant DMS-1254812, PI (2013-2019).
- NSF FRG grant DMS-1361143, PI (2014-2018).
- NSF grant DMS-1200875, PI (2012-2015).
- Sloan fellowship (2010-2013).
- NSF grant DMS-0968968, PI (2009-2012).
- NSF grant DMS-1100007, PI (conference proposal: Calabi-Yau workshop, Toronto, 2011).
- NSF grant DMS-1066154 and DMS-1360586 , Co-PI (conference proposal: AGNES, Stony Brook, 2011 and 2014).
- Summer research award (U. Michigan, 2007).
- PhD with distinction (Columbia U., 2006).
- Fellowships and scholarships at Columbia U., U. of Kaiserslautern, U. of Bucharest (1996-2006).
- First prize at national Math Olympiads (Romania) in 1997, 1996, 1993.

Invited Talks*Lecture Series*

(invited expository lectures; typically 2-4 lectures during a week)

1. *Moduli and periods for hyper-Kähler manifolds*, KAIST (Daejeon, Korea), August 2019.
2. *Birational Geometry of the moduli space of $K3$ surfaces*, Shanghai, November 2018.
3. *Period maps and Moduli*, School on degeneration of Calabi-Yau varieties and arithmetic, Freiburg, October 2017.
4. *Birational geometry of moduli spaces*, Algebraic Geometry and Complex Geometry, CIRM (Luminy), January 2017.

5. *GIT and moduli*, CIMPA-ICTP-CIMAT School on Moduli of Curves, Guanajuato (Mexico), Feb 2016.
6. *Lectures on moduli of cubics*, Moduli spaces of real and complex varieties, Angers (France), June 2014.
7. *Lectures on the construction and compactification of moduli spaces*, KAIST (Korea), March 2014.
8. *Classical period domains*, Graduate workshop “Hodge Theory in String Theory”, Fields Institute, November 2013.
9. *Degenerations and compactifications*, Introductory Workshop on Calabi-Yau Varieties, Fields Institute, August 2013.
10. *Classical period domains*, Summer School on Period Domains, Algebraic Cycles, and Arithmetic, Vancouver, July 2013.
11. *Perspectives on Moduli*, Advanced Course on “Compactifying Moduli Spaces”, CRM (Barcelona), May 2013.
12. *Degenerations of K_3 surfaces and Calabi-Yau threefolds*, Workshop on Calabi-Yau varieties, Fields Institute, August 2013.

Conferences and Workshops

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13. Motives and Hodge theory, Mittag-Leffler Institute (Stockholm), October 2021
14. Moduli and Hodge Theory, IMSA (Miami), February 2021
15. Applications of O-Minimality to Hodge Theory, IMSA (Miami), November 2020.
16. Komplexe Analysis, Oberwolfach, August 2020.
17. Algebraic and complex geometry, Berkeley, August 2020.
18. Discrete groups and Moduli, Nagoya, June 2019.
19. Symposium on Hodge Theory, Arithmetic and Moduli, Vancouver, May 2019.
20. Workshop on birational geometry and related topics, Shanghai, November 2018.
21. Differential, Algebraic and Topological Methods in Complex Algebraic Geometry, Cetraro (Italy), September 2018.
22. Arithmetic and Geometry of Cubic Hypersurfaces, Hannover, August 2018. Symposium in geometry and differential equations
23. Modern Algebraic Geometry, Beijing, July 2018.
24. Recent progress in the arithmetic and geometry of K_3 surfaces, Trento (Italy), July 2018.
25. Automorphic Forms and Algebraic Geometry, St. Petersburg, May 2018.
26. Modern Geometry (Griffiths’ 80), Miami, March 2018.
27. Homological Mirror Symmetry and Hodge Theory, Harvard, January 2018.
28. Commutative Algebra meeting Algebraic Geometry, Bucharest, June 2017.

¹The list of talks is somewhat out-dated

29. Curves, Sheaves, and K_3 surfaces, Berlin, Feb 2017.
30. NoGAGS (Hamburg), Jan 2017.
31. Workshop on Stability and moduli spaces, AIM, Jan 2017
32. Hyper-Kähler Manifolds, Hodge Theory and Chow Groups, Sanya (China), Dec 2016.
33. Algebraic geometry days in Poitiers, Poitiers, Nov 2016.
34. Cubic fourfolds, hyperkaehler manifolds and algebraic cycles, Lyon, Oct 2016.
35. Derived categories and Chow groups of hyperkaehler and Calabi-Yau varieties, Stony Brook, Sept 2016.
36. Algebraic cycles and moduli, CRM (Montreal), June 2016.
37. Moduli spaces and Modular forms, Oberwolfach, April 2016.
38. Deformation and Moduli, Busan (Korea), January 2016.
39. Moduli spaces in Geometry, Luminy, October 2015.
40. Moduli and Birational geometry (AMS Summer Institute), Salt Lake City, July 2015.
41. Perspectives on complex algebraic geometry, Columbia University, May 2015.
42. K_3 , Enriques surfaces and related topics, Nagoya, November 2014.
43. Fundamental groups and periods, IAS (Princeton), Oct 2014.
44. Algebraic Geometry Summer Days, Bucharest (Romania), June 2014.
45. Workshop on K_3 's and their moduli, Schiermonnikoog (Netherlands), May 2014.
46. Development of Moduli theory, Kyoto, June 2013.
47. Recent Advances in Hodge Theory (Period domains, Algebraic cycles, and Arithmetic), Vancouver, June 2013.
48. Deformation and Moduli in Complex Geometry, KIAS, March 2013.
49. New Trends in Arithmetic and Geometry of Algebraic Surfaces, Luminy, March 2013.
50. Log minimal model program for moduli spaces, Palo Alto CA, December 2012.
51. Algebraic geometry, modular forms and applications to physics, Edinburgh, November 2012.
52. Algebraic and Complex Geometry, Hanover, September 2012.
53. Komplex Analysis, Oberwolfach, September 2012.
54. Arithmetic, Motives and Moduli spaces, Paris, January 2012.
55. Workshop on Moduli and Birational Geometry, Postech (Korea), July 2011.
56. Compact Moduli and Vector Bundles, Athens GA, October 2010.
57. Workshop on elliptic fibrations and K_3 surfaces, Berlin, July 2010.
58. Conference on complex algebraic geometry, Paris, June 2010.
59. North German Algebraic Geometry Seminar (NoGAGS), Hanover, June 2010.

60. Algebraic Geometry Northeastern Series (AGNES), Amherst MA, April 2010.
61. Higher dimensional Algebraic Geometry, Taipei, March 2010.
62. Conference on Algebraic Geometry and Arithmetic, Essen, February 2010.
63. Workshop on moduli and birational geometry, KIAS (Seoul), December 2009.
64. First joint meeting of the AMS and the Korean Mathematical Society, Seoul, December 2009.
65. Workshop on Complex Geometry, KIAS (Seoul), September 2009.
66. Moduli and discrete groups, RIMS (Kyoto), June 2009.
67. Arithmetic and Algebraic Geometry related to moduli spaces, Tokyo, January 2009.
68. Workshop on Aspects of Moduli, Pisa, June 2008.
69. Midwestern Algebraic Geometry Workshop, Columbus OH, March 2007.

Colloquia

70. University of Pennsylvania, October 2018.
71. Washington University, February 2018.
72. University of Bayreuth, December 2017.
73. Duke University, December 2017.
74. University of Mainz, November 2017.
75. Rutgers University (Newark), December 2014.
76. University of Kyoto, June 2013.
77. University of North Carolina, February 2009.
78. Stony Brook University, February 2009.
79. University of Wisconsin, January 2009
80. University of California at Davis, January 2009.
81. Boston College, January 2009.
82. University of California at Irvine, January 2009.
83. Michigan State University, December 2008.
84. Ohio State University, December 2008.
85. Rice University, November 2008.

Seminars

Over 50 talks given in specialized research seminars (algebraic geometry or related fields) including:

Tsinghua, IBS (Korea), Pisa, Princeton, Zurich, Nice, Dijon, Yale, TAMU, Stanford, University of Mainz, Université Paris VI, Boston College, Nagoya University, Penn State, Texas A&M, KIAS (Seoul), University of Bonn, University of Rome I, University of Pennsylvania, MSRI, University of Illinois at Urbana-Champaign, Columbia University, University of Wisconsin, Ohio State University, MIT, University of Texas, University of Michigan, University of Georgia, University of Illinois at Chicago, Harvard University, Rice University, Johns Hopkins University, Stony Brook University, Humboldt University (Berlin).

Service

Activities Organized

- Co-organizer of the workshop *Discrete groups and Moduli*, (Nagoya, June 2019).
- Co-organizer of the workshop *Hodge Theory, Moduli and Representation Theory* [final conference for the FRG project DMS-1361143], (Stony Brook, August, 2017).
- Co-organizer of the school *Positivity in Arithmetic and Geometry*, (Orsay, May 2017).
- Co-organizer of the workshop *Hyper-Kähler Manifolds, Hodge Theory and Chow Groups* (Sanya, China, Dec 2016)
- Co-organizer of the workshop *Calabi-Yau varieties: Arithmetic, geometry and physics* (Herstmonceux Castle, East Sussex, UK, June 2016)
- Co-organizer of the workshop *Algebraic cycles and moduli* (CRM Montreal, June 2016)
- Co-organizer of the thematic program on *Complex, p -adic, and logarithmic Hodge theory and their applications* (SCGP, Mar-Apr, 2016)
- Co-organizer of the thematic program *Moduli spaces and singularities in algebraic and Riemannian geometry* (SCGP, Aug-Nov, 2015)
- Co-organizer of the workshop *Collapsing Calabi-Yau Manifolds* (SCGP, Aug 31-Sept 4, 2015)
- Co-organizer of the workshop *Perspectives on complex algebraic geometry* (Columbia University, May 22-25, 2015), supported by NSF.
- Co-organizer of the workshop *New techniques in birational geometry* (Stony Brook, April 6-10, 2015), supported by NSF.
- Organizer of FRG Workshop (Stony Brook, January 5-8, 2015)
- Co-organizer of the workshop *K_3 , Enriques surfaces and related topics* (Nagoya, November 2014).
- Co-organizer of the SBU Mini-courses in Geometry, in particular of *Stability Day* (Stony Brook, December 2013), *Invariants of Singularities in zero and positive characteristics* (Stony Brook, December 2015).
- Co-organizer of a thematic program on *Calabi-Yau Varieties: Arithmetic, Geometry, and Physics* (Fields Institute, Toronto, Jul.-Dec 2013) supported by Fields Institute and NSF.
- Co-organizer of *Workshop on the geometry and arithmetic of Calabi-Yau varieties* (Fields Institute, Toronto, Aug. 2011); partially supported by NSF grant DMS-1100007 (PI).

- Co-organizer of the AGNES series of meetings; partially supported by NSF grant DMS-1066154 (Co-PI).
- Co-organizer of the Colloquium (Stony Brook, 2014-2017), algebraic geometry seminar (Stony Brook), graduate student algebraic geometry seminar (Stony Brook), post-doc algebraic geometry seminar (U. Michigan).

Service to the profession

- Refereed for several journals including Annals of Math., Journal of AMS, Inv. Math., J. Eur. Math. Soc., Duke Math. J., Documenta Math., J. Alg. Geom., J. Algebra, IMRN, Trans. of AMS, Math. Z., Proc. of AMS, Michigan Math. J., JPAA, Nagoya Math. J.
- Refereed grant proposals for NSF, NSA, ERC, NWO (Netherlands Organization for Scientific Research), and Simons Foundation.
- Reviewer for Mathematical Reviews.
- Thesis committee: G. Urzua (Michigan, I. Dolgachev), M. Shen (Columbia, J. de Jong), Z. Tian (Stony Brook, J. Starr), Y. Zhu (Stony Brook, J. Starr), A. Popa (Stony Brook, A. Zinger).

University Service

- Chair of the chair search committee (Stony Brook Math).
- University Senate (Stony Brook).
- Hiring Committee (Stony Brook Math).
- Past Committees: Professional Development Seminar, RTG Committee, Library committee, Undergraduate Research Coordinator.

Mentoring and Advising

- PhD advisor for Y. Kim, A. Viktorova, L. Marquand.
- NSF Postdoctoral mentor for A. Brunyate
- PhD advisor for P. Gallardo (May 2014, now at Washington U.) and Z. Zhang (December 2014, now at U. Colorado).
- Honors thesis advisor for T. Do (May 2014, now at MIT) and K. Ascher (May 2012, now at Princeton).
- Postdoctoral mentor for D. Jensen (now TT faculty at University of Kentucky), G. Saccà (now TT faculty at Columbia), F. Greer (now at IAS/ Michigan State (TT)).

Teaching

Involved in undergraduate and graduate teaching since 2002 at Columbia University, University of Michigan, and Stony Brook University. Instructor for over twenty classes including:

- MAT 589 - Intro to Algebraic Geometry (Spring 2023)
- MAT 211 - Intro to linear algebra (Fall 2022)
- MAT 312/AMS 351 – Applied Algebra (Fall 2022)

- MAT 534 - Algebra I (Fall 2021)
- MAT 131 - Calculus I (Fall 2021)
- MAT 402 – Introduction to Algebraic Geometry (Undergraduate; Spring 2021)
- MAT 685 – Hodge theory and Geometry (Spring 2021)
- MAT 312/AMS 351 – Applied Algebra (Spring 2020)
- MAT 535 – Algebra II (Spring 2020)
- MAT 589 – Introduction to Algebraic Geometry (Spring 2019)
- MAT 126 – Calculus B (Spring 2019)
- MAT 614 – Topics in Algebraic Geometry: Introduction to MMP (Fall 2018)
- MAT 615 – Topics in Algebraic Geometry: Complex Surfaces (Spring 2018)
- MAT 312 / AMS 351 - Applied Algebra (Fall 2017)
- MAT 534 - Algebra I (Fall 2017)
- MAT 360 - Geometric Structures (Spring 2016)
- MAT 614 - Topics in Algebraic Geometry “*Perspectives on Moduli*” (Fall 2015)
- MAT 122 - Overview of Calculus, with Applications (Fall 2015)
- MAT 402 - Topics in Number Theory (Spring 2014)
- MAT 402 - Topics in Algebra (Spring 2013)
- MAT 552 - Intro to Lie groups and Lie algebras (Spring 2013)
- MAT 536 - Algebra III: Commutative Algebra (Fall 2012)
- MAT 122 - Overview of Calculus, with Applications (Fall 2012)
- MAT 626 - Topics in algebraic geometry: Deformation Theory (Fall 2011)
- MAT 401 - Undergraduate algebraic geometry (Fall 2011)
- MAT 534 - Algebra I (Fall 2010)
- MAT 313 - Abstract Algebra (Fall 2010, Fall 2009)
- MAT 131 - Calculus I (Spring 2010)
- MAT 125 - Calculus A (Spring 2010)
- Linear Algebra (Fall 2008, Winter 2008)
- Probabilities (Fall 2008, Fall 2007)
- Complex Analysis (Winter 2007)
- Calculus II (Fall 2006, Summer 2004, Spring 2004, Summer 2003)
- College Algebra (Fall 2003)

Other teaching activities include guiding more than 10 independent study courses at Stony Brook, and running Putnam preparation sessions at Columbia.