

CLAUDIU RAICU

CURRICULUM VITAE

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EMPLOYMENT

- 2021– Professor, Department of Mathematics, University of Notre Dame.
- 2017–21 Associate Professor, Department of Mathematics, University of Notre Dame.
- 2014–17 Assistant Professor, Department of Mathematics, University of Notre Dame.
- Spring 2013 Postdoctoral Scholar, Mathematical Sciences Research Institute, Berkeley.
- 2011–14 Instructor, Department of Mathematics, Princeton University.

EDUCATION

- 2007–11 University of California, Berkeley, Ph.D. Mathematics.
Advisor: David Eisenbud. Thesis: *Secant Varieties of Segre-Veronese Varieties*.
- 2003–07 University of Bucharest, B.S. Mathematics.
- 2005–07 Superior Normal School of Bucharest.

HONORS AND AWARDS

- 2019–23 PI on NSF Award DMS - 1901886.
– *Research grant: “Homological Explorations and Symmetry”.*
- 2019 Gheorghe Țițeica Prize of the Romanian Academy.
- 2018–21 Co-PI on NSF Awards DMS - 1806221 and DMS - 1904501.
– *Conference grant: “Center for Mathematics, University of Notre Dame”.*
- 2017 Co-PI on NSF Award DMS - 1702114.
– *Conference grant: “A view towards algebraic geometry”.*
- 2016–19 PI on NSF Award DMS - 1600765.
– *Research grant: “Employing symmetry in commutative algebra”.*
- 2016–19 Sloan Research Fellowship.
- 2013–16 PI on NSF Award DMS - 1458715 (previously 1303042).
– *Research grant: “Spaces of tensors and their syzygies via representation theory and combinatorics”.*
- 2013 Huneke Endowed Postdoctoral Scholar, MSRI.
- 2012 “Excellence in Teaching” E-Council Teaching Award, Princeton University.
– *Awarded by the Undergraduate and Graduate Engineering Council.*

- 2011 Kenneth Ribet & Lisa Goldberg award in Algebra, U.C. Berkeley.
– *U.C. Berkeley Thesis award.*
- 2007–08 Simons Fellowship, University of California, Berkeley.
- 2006 Grand First Prize in the International Mathematics Competition for University Students.
– *international Putnam-like mathematical competition: <http://www.imc-math.org/>*
- 2002–03 Two Silver Medals in the International Mathematical Olympiad.
– *international mathematical competition for high-school students: <http://www.imo-official.org/>*

PUBLICATIONS AND PREPRINTS

1. *Cohomology of line bundles on the incidence correspondence*, with Zhao Gao, arXiv: 2210.03656.
2. *Koszul modules with vanishing resonance in algebraic geometry*, with Marian Aprodu, Gavril Farkas, and Jerzy Weyman, arXiv: 2201.00839.
3. *Borel–Moore homology of determinantal varieties*, with András C. Lőrincz, arXiv: 2110.08197, to appear in *Algebraic Geometry*.
4. *Determinants, Gröbner Bases and Cohomology*, with Winfried Bruns, Aldo Conca, Matteo Varbaro, Springer Monographs in Mathematics. Springer, Cham, 2022.
5. *Topological invariants of groups and Koszul modules*, with Marian Aprodu, Gavril Farkas, Ștefan Papadima and Jerzy Weyman, *Duke Mathematical Journal* **171**, no. 10, 2013–2046, 2022.
6. *Euler obstructions for the Lagrangian Grassmannian*, with Paul LeVan, *Algebraic Combinatorics* **5**, no. 2, 299–318, 2022.
7. *Local Euler obstructions for determinantal varieties*, with András C. Lőrincz, *Topology and its Applications* **313**, Paper No. 107984, 2022 (special issue: proceedings of the conference *Hypersurface Arrangements and Singularities, 2019*).
8. *On some modules supported in the Chow variety*, with Steven V Sam and Jerzy Weyman, *Vietnam Journal of Mathematics* **50**, no. 2, 501–521, 2022 (special issue in honor of Bernd Sturmfels).
9. *An equivariant Hochster’s formula for \mathfrak{S}_n -invariant monomial ideals*, with Satoshi Murai, *Journal of the London Mathematical Society* **105**, no. 3, 1974–2010, 2022.
10. *Bi-graded Koszul modules, K3 carpets, and Green’s conjecture*, with Steven V Sam, *Compositio Mathematica*, Volume **158**, no. 1:33–56, 2022.
11. *Feasibility criteria for high-multiplicity partitioning problems*, *Journal of Pure and Applied Algebra* **226**, no. 6, Paper No. 106937, 2022.
12. *Hermite reciprocity and Schwarzenberger bundles*, with Steven V Sam, *Commutative algebra 689–721*, Expository papers dedicated to David Eisenbud on the occasion of his 75th birthday, edited by Irena Peeva. Springer, Cham, 2021.
13. *Koszul modules*, *Recent developments in commutative algebra*, edited by Aldo Conca, Srikanth B. Iyengar and Anurag K. Singh. *Lecture Notes in Mathematics* **2283**: 33–57, 2021.
14. *Hodge ideals for the determinant hypersurface*, with Michael Perlman, *Selecta Math. (N.S.)* **27**, no. 1, Paper No. 1, 2021.

15. *Relations between the 2×2 minors of a generic matrix*, with Hang Huang, Michael Perlman, Claudia Polini, and Alessio Sammartano, Adv. Math. **386**, Paper No. 107807, 2021.
16. *Regularity of \mathfrak{S}_n -invariant monomial ideals*, J. Combin. Theory Ser. A **177**, Paper No. 105307, 2021.
17. *Iterated local cohomology groups and Lyubeznik numbers for determinantal rings*, with András C. Lőrincz, Algebra & Number Theory **14**, no. 9:2533–2569, 2020.
18. *Koszul modules and Green’s conjecture*, with Marian Aprodu, Gavril Farkas, Ștefan Papadima and Jerzy Weyman, Invent. Math. **218**, Issue 3, 657–720, 2019.
19. *Computing Schur complexes*, with Michael K. Brown, Hang Huang, Robert P. Laudone, Michael Perlman, Steven V Sam, and João Pedro Santos, J. Softw. Algebra Geom. **9**, no. 2, 111–119, 2019.
20. *On the (non-)vanishing of syzygies of Segre embeddings*, with Luke Oeding and Steven V Sam, Algebraic Geometry **6** (5), 571–591, 2019.
21. *Equivariant \mathcal{D} -modules on binary cubic forms*, with András C. Lőrincz and Jerzy Weyman, Comm. Algebra **47**, no. 6, 2457–2487, 2019 (special issue in honor of Gennady Lyubeznik).
22. *Syzygies of determinantal thickenings and representations of the general linear Lie superalgebra*, with Jerzy Weyman, Acta Math. Vietnam. **44**, no. 1, 269–284, 2019 (special issue: proceedings of the conference *The Prospects for Commutative Algebra*).
23. *Regularity and cohomology of determinantal thickenings*, Proceedings of the London Mathematical Society **116**, no. 2:248–280, 2018.
24. *Homological invariants of determinantal thickenings*, Bull. Math. Soc. Sci. Math. Roumanie, Volume **60** (108), no. 4:425–446, 2017 (special issue in honor of Dorin Popescu).
25. *Bernstein–Sato polynomials for maximal minors and sub-maximal Pfaffians*, with András C. Lőrincz, Uli Walther, and Jerzy Weyman, Advances in Mathematics **307**:224–252, 2017.
26. *The syzygies of some thickenings of determinantal varieties*, with Jerzy Weyman, Proceedings of the American Mathematical Society **145**:49–59, 2017.
27. *Characters of equivariant \mathcal{D} -modules on Veronese cones*, Transactions of the American Mathematical Society **369**, no. 3:2087–2108, 2017.
28. *Local cohomology with support in ideals of symmetric minors and Pfaffians*, with Jerzy Weyman, Journal of the London Mathematical Society, Volume **94**, Issue 3:709–725, 2016.
29. *Characters of equivariant \mathcal{D} -modules on spaces of matrices*, Compositio Mathematica, Volume **152**, Issue 9:1935–1965, 2016.
30. *Representation stability for syzygies of line bundles on Segre–Veronese varieties*, Journal of the European Mathematical Society **18**, no. 6:1201–1231, 2016.
31. *Introduction to uniformity in commutative algebra*, with Craig Huneke, Mathematical Sciences Research Institute Publications, **67**:163–190, Commutative Algebra and Noncommutative Algebraic Geometry, Cambridge Univ. Press, Cambridge, 2015.

32. *Non-simplicial decompositions of Betti diagrams of complete intersections*, with Courtney Gibbons, Jack Jeffries, Sarah Mayes, Branden Stone, and Bryan White, *Journal of Commutative Algebra* **7**, no. 2:189–206, 2015.
33. *Local cohomology with support in generic determinantal ideals*, with Jerzy Weyman, *Algebra & Number Theory* **8**, no. 5:1231–1257, 2014.
34. *Local cohomology with support in ideals of maximal minors and sub-maximal Pfaffians*, with Jerzy Weyman and Emily Witt, *Advances in Mathematics* **250**:596–610, 2014.
35. *Products of Young symmetrizers and ideals in the generic tensor algebra*, *Journal of Algebraic Combinatorics* **39**, no. 2, 247–270, 2014.
36. *Tangential varieties of Segre–Veronese varieties*, with Luke Oeding, *Collectanea Mathematica* **65**, no. 3:303–330, 2014.
37. *3×3 Minors of Catalecticants*, *Mathematical Research Letters* **20**, no. 4:745–756, 2013.
38. *Secant varieties of Segre–Veronese varieties*, *Algebra & Number Theory* **6**, no. 8:1817–1868, 2012.
39. *Affine toric equivalence relations are effective*, *Proceedings of the American Mathematical Society* **138**:3835–3847, 2010.
40. Appendix to J. Kollár, *Quotients by finite equivalence relations*, *Mathematical Sciences Research Institute Publications*, **59**:227–256, *Current developments in algebraic geometry*, Cambridge Univ. Press, Cambridge, 2012.

INVITED TALKS AND LECTURES

- 2023 Géométrie écrite : algèbre commutative, C.I.R.M. workshop, Luminy (January).
- 2022 Resonance, topological invariants of groups, moduli, Humboldt University, Berlin (November).
 Mathematics Department Colloquium, University of Notre Dame (October).
 AMS Special Session on Commutative Algebra, University of Utah (October).
 Recent Advances in Classical Algebraic Geometry, Kraków (June).
 Effective Methods in Algebraic Geometry, Kraków (June).
 75 + 80 = 155 years of commutative algebra: a conference in honor of Bruns and Herzog, Osnabrück (June).
 Undergraduate Summer School (4 lectures), Thematic Program in p-adic L-functions and Eigenvarieties, University of Notre Dame (June).
 Open Problems in Algebraic Combinatorics, University of Minnesota (May).
 Geometry Seminar, Texas A&M University (May).
 AMS Special Session on Recent Developments in Commutative Algebra, virtually at Purdue University (March).
 AMS Special Session on Homological Methods in Commutative Algebra, virtually at Tufts University (March).

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- 2021 Virtual Commutative Algebra Seminar, Indian Institute of Technology Bombay (December).
Mathematics Department Colloquium, New Mexico State University (November).
Commutative Algebra Seminar, virtually at University of Illinois at Chicago (November).
Symmetries on Polynomial Ideals and Varieties workshop, Oberwolfach (September).
Differential Operators in Commutative Algebra Seminar, virtual (August).
SIAM Conference on Applied Algebraic Geometry, virtual (August).
Classical Algebraic Geometry, Oberwolfach (June).
Workshop for Young Researchers in Mathematics, virtually at Ovidius University, Constanța (May).
Singularities in the Midwest, virtually at University of Wisconsin–Madison (May).
Algebra Seminar, virtually at Jagiellonian University, Kraków (March).
- 2020 Mathematics Department Colloquium, Cleveland State University, virtual (November).
AMS Special Session on Recent Developments in Commutative Algebra, virtually at University of Texas at El Paso (September).
Colloquium, joint Northwestern University, the University of Chicago, and the University of Illinois at Chicago, virtual (August).
Free Resolutions and Representation Theory, hosted virtually by ICERM (August).
Fellowship of the Ring Seminar, hosted virtually by MSRI (May).
Algebra, Geometry and Combinatorics Day, University of Illinois at Urbana–Champaign (March).
Commutative algebra and Combinatorics Seminar, University of Bucharest (January).
- 2019 Hyperplane arrangements and Singularities, University of Tokyo (December).
Commutative Algebra Seminar, University of Connecticut (October).
Algebraic Geometry Seminar, University of Illinois at Urbana–Champaign (October).
Algebra Seminar, University of Arkansas (October).
Mathematics Department Colloquium, University of Arkansas (October).
AMS Special Session on Combinatorial Algebraic Geometry, Madison (September).
SIAM Conference on Applied Algebraic Geometry, Bern (July).
CIME-CIRM Course (4 lectures), Recent developments in Commutative Algebra, Leviso Terme (July).
The Ninth Congress of Romanian Mathematicians, Galați (June).
Undergraduate Summer School (4 lectures), Thematic Program in Commutative Algebra and its Interactions with Algebraic Geometry, University of Notre Dame (June).

- Algebraic Geometry Seminar, University of California, San Diego (May).
Commutative Algebra Seminar, Purdue University (April).
Mathematics Department Colloquium, University of Michigan (April).
Singularities in the Midwest, University of Wisconsin–Madison (March).
Singularities and Homological Aspects of Commutative Algebra, Oberwolfach (February).
- 2018 Algebraic Geometry Seminar, University of Illinois at Chicago (November).
Classical Algebraic Geometry, Oberwolfach (July).
New Trends in Syzygies, Banff (June).
Algebraic Geometry Seminar, Institute of Mathematics of the Romanian Academy (June).
Topology and Geometry: A conference in memory of Ștefan Papadima, Bucharest (May).
Mathematics Department Colloquium, Auburn University (April).
Singularities, Toric Geometry and differential equations, TU Chemnitz (March).
Number Theory and Algebraic Geometry Seminar, Simon Fraser University (March).
Algebraic Geometry Seminar, Institute of Mathematics of the Romanian Academy (January).
- 2017 Instruments of Algebraic Geometry, Bucharest (September).
The Prospects for Commutative Algebra, Osaka (July).
Commutative Algebra meeting Algebraic Geometry, University of Bucharest (June).
Undergraduate Summer School (4 lectures), Thematic Program in Kähler geometry, University of Notre Dame (June).
MSRI Summer Graduate School (5 lectures), Commutative Algebra and Related Topics, Okinawa Institute of Science and Technology (May).
Spring Lecture Series, University of Arkansas (March).
- 2016 Harvard/MIT Algebraic Geometry Seminar (October).
Special Session on Homological Methods, XXI Coloquio Latinoamericano de Álgebra, Buenos Aires (July).
Midwest Commutative Algebra and Algebraic Geometry Conference, Notre Dame (May).
Commutative Algebra Seminar, University of Utah (May).
Free Resolutions, Representations, and Asymptotic Algebra, Banff (April).
Algebraic Geometry Seminar, University of Wisconsin–Madison (March).
Algebraic Geometry Seminar, The Ohio State University, Columbus (February).
- 2015 Caltech Algebraic Geometry Seminar (November).
AMS Special Session on Commutative Algebra, Chicago (October).

- Syzygies in Algebra and Geometry, Busan (August).
- Conference on \mathcal{D} -modules in Commutative Algebra, CIMAT, Guanajuato (August).
- Differential and combinatorial aspects of singularities, T.U. Kaiserslautern (August).
- AMS Summer Institute in Algebraic Geometry, University of Utah, Salt Lake City (July).
- The Eighth Congress of Romanian Mathematicians, Iași (June).
- Minimal free resolutions, Betti numbers, and combinatorics, ICMS, Edinburgh (June).
- Algebraic Geometry Seminar, Princeton University (May).
- International Conference on Representation Theory and Commutative Algebra, University of Connecticut (April).
- Local Cohomology and Group Actions (minicourse), RTG Workshop on Local Cohomology, University of Illinois at Chicago (February).
- 2014 Tensors in Computer Science and Geometry, Simons Institute for the Theory of Computing, Berkeley (November).
- AMS Special Session on Developments from the MSRI Programs in Commutative Algebra and Noncommutative Algebraic Geometry and Representation Theory, San Francisco State University (October).
- Algebraic Geometry Seminar, University of Michigan (September).
- AMS Special Session on New Trends in Toric Varieties, Eau Claire (September).
- Meeting On Combinatorial Commutative Algebra, Levico Terme (September).
- Notre Dame Algebraic Geometry/Commutative Algebra Seminar (September).
- Classical Algebraic Geometry, Oberwolfach (July).
- Macaulay2 Conference, University of Illinois at Urbana–Champaign (June).
- Algebra Seminar, University of Connecticut (April).
- Valley Geometry Seminar, University of Massachusetts (March).
- Mathematics Department Colloquium, Kansas University (February).
- Mathematics Department Colloquium, Pennsylvania State University (February).
- Mathematics Department Colloquium, Purdue University (February).
- Mathematics Department Colloquium, University of Notre Dame (January).
- Mathematics Department Colloquium, University of Illinois at Urbana–Champaign (January).
- Mathematics Department Colloquium, Virginia Tech (January).
- Mathematics Department Colloquium, University of South Carolina (January).
- Mathematics Department Colloquium, Boston College (January).

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- 2013 Algebraic Geometry Seminar, University of Illinois at Urbana–Champaign (November).
Algebraic Geometry Seminar, University of Illinois at Chicago (October).
Working Algebraic Geometry Seminar, Purdue University (October).
Commutative Algebra Seminar, University of Nebraska–Lincoln (September).
SIAM Conference on Applied Algebraic Geometry, Fort Collins (August).
Special Session on Commutative Algebra, Joint International Meeting of AMS and RMS (June).
Representation Theory, Geometry, and Combinatorics Seminar, U.C. Berkeley (April).
Representation Theory, Homological Algebra, and Free Resolutions Workshop, MSRI (February).
MSRI Postdoc Seminar (February).
- 2012 Tensors and their Geometry in High Dimensions, RTG Workshop, U.C. Berkeley (September).
Special Session on Algebraic Geometry and its Applications, AMS Sectional Meeting, University of Kansas, Lawrence (March).
NC State University Symbolic Computation Seminar (March).
Columbia Algebraic Geometry Seminar (March).
Princeton Discrete Mathematics Seminar (March).
Pennsylvania State University Applied Algebra Seminar (February).
- 2011 SIAM Conference on Applied Algebraic Geometry, Raleigh (October).
Princeton Algebraic Geometry Seminar (October).
Macaulay2 Workshop, Institute for Mathematics and its Applications, Minneapolis (August).
Géométrie Algébrique en Liberté, Berlin (July).
MIT Combinatorics Seminar (February).
Joint Harvard/MIT Algebraic Geometry Seminar (February).
Northeastern Geometry-Algebra-Singularities-Combinatorics Seminar (January).
University of Michigan Algebraic Geometry Seminar (January).
U.C. Davis Geometry and Topology Seminar (January).
Texas A&M Geometry Seminar (January).
Queen’s Curves Seminar (January).
Queen’s Algebraic Geometry Seminar (January).
- 2010 U.C. Berkeley Algebraic Geometry and Commutative Algebra Seminar (September).
Special Session on Commutative Algebra and Representation Theory, Joint AMS–SMM meeting, UC Berkeley (June).
- 2009 UC Berkeley Algebraic Geometry and Commutative Algebra Seminar (November).

TEACHING EXPERIENCE

- 2021– Professor, University of Notre Dame. *Basic Algebra I (Groups, Rings & Modules); Introduction to Algebraic Geometry; Introduction to Linear Algebra and Differential Equations.*
- 2017–21 Associate Professor, University of Notre Dame. *Basic Algebra II (Fields and Galois theory, homological and commutative algebra); Introduction to Linear Algebra and Differential Equations; Honors Algebra III (Group Theory); Honors Algebra IV (Rings, Fields, and Galois Theory); Multivariable Calculus; Introduction to Algebraic Geometry; Homological Commutative Algebra and Symmetry.*
- 2014–17 Assistant Professor, University of Notre Dame. *Introduction to Linear Algebra and Differential Equations; Calculus II; Introduction to Toric Varieties; Introduction to Algebraic Geometry.*
- 2011–14 Instructor, Princeton University. *Multivariable Calculus; Linear Algebra and Applications; Abstract Algebra; Junior Seminar on Coxeter Groups.*
- 2013 Instructor in the Marin Math Circle.
- 2009–11 Graduate Student Instructor, UC Berkeley. *Calculus in One Variable; Linear Algebra and Differential Equations.*
- 2008–11 Instructor in the Berkeley Math Circle.
- 2008 Teaching Assistant, UC Berkeley. *Elementary Algebraic Geometry; Groups, Rings and Fields.*
- 2004–07 Mathematics Olympiad Instructor, International Computer High School of Bucharest.
- 2004–07 Instructor in the Romanian training program for the International Mathematical Olympiad.

POSTDOC MENTORING

- 2021– Keller VandeBogert, University of Notre Dame.
- 2018–20 Alessio Sammartano, University of Notre Dame.

GRADUATE ADVISING

- 2020– Ethan Reed, University of Notre Dame.
- 2020– Juan Lanfranco, University of Notre Dame.
- 2019– Jacob Zoromski, University of Notre Dame.
- 2019– Paul LeVan, University of Notre Dame.
- 2018– Lizda Moncada, University of Notre Dame.
- 2020–21 Deirdre Coulter, University of Notre Dame.
- 2017–22 Zhao Gao, University of Notre Dame.
- 2015–20 Michael Perlman, University of Notre Dame.

UNDERGRADUATE ADVISING

- 2017–18 Caitlyn Booms, University of Notre Dame, senior thesis: “Homological Algebra of Monomial Ideals”.
- 2014 Derek Ou, Princeton University, junior thesis: “Identifying sums of d -th powers of linear forms in two variables”.
- Mason Soun, Princeton University, junior thesis: “Kazhdan-Lusztig Polynomials for Grassmannian Permutations”.

SERVICE

- Co-organizer of the MSRI program in “Commutative Algebra”, Spring 2024.
- Co-organizer of the AMS special session “Homological Methods in Commutative Algebra”, virtually at Creighton University, Omaha, October 2021.
- Co-organizer of the ICERM workshop “D-modules, Group Actions, and Frobenius: Computing on Singularities”, August 2021.
- Co-organizer of the Algebra, Geometry and Combinatorics Day XXI, virtually at University of Notre Dame, April 2021.
- Co-organizer of the Thematic Program in Commutative Algebra and its Interactions with Algebraic Geometry, at University of Notre Dame, June 2019.
- Co-organizer of the AMS special session “Recent Advances in Homological and Commutative Algebra”, at the Joint Mathematics Meetings, Baltimore, January 2019.
- Co-organizer of the conference “A View Toward Algebraic Geometry”, in honor of the 70th birthday of David Eisenbud, at the Harbor View Hotel, Martha’s Vineyard, May 2017.
- Co-organizer of the mini-symposium “Group actions in algebraic geometry and commutative algebra”, at the SIAM Conference on Applied Algebraic Geometry, Daejeon, August 2015.
- Co-organizer of the workshop “Local Cohomology”, at University of Illinois at Chicago, February 2015.
- Co-organizer of the workshop “Symbolic and Numerical Methods for Tensors and Representation Theory”, at the Simons Institute for the Theory of Computing, Berkeley, November 2014.
- Co-organizer of the Princeton Algebraic Geometry Seminar.
- Co-organizer of the mini-symposia “Computations and Effective Bounds in Commutative Algebra” and “Effective Methods in D-modules and Singularities”, at the SIAM Conference on Applied Algebraic Geometry, Fort Collins, August 2013.
- Referee for: Acta Mathematica Vietnamica, Advances in Mathematics, Algebra & Number Theory, Algebraic Geometry, Algebras and Representation Theory, American Journal of Mathematics, Annals of Combinatorics, Annals of Mathematics, Communications in Algebra, Communications in Contemporary Mathematics, Compositio Mathematica, Documenta Mathematica, Duke Mathematical Journal, European Journal of Mathematics, EMS Surveys in Mathematical Sciences,

Foundations of Computational Mathematics, International Mathematics Research Notices, Inventiones Mathematicae, Journal of Algebra, Journal of Algebra and its Applications, Journal of Algebraic Combinatorics, Journal of Combinatorial Algebra, Journal of Commutative Algebra, Journal of the European Mathematical Society, Journal of the London Mathematical Society, Journal of Pure and Applied Algebra, Journal of Symbolic Computation, Lecture Notes in Mathematics, Linear Algebra and Its Applications, Mathematische Zeitschrift, NSA Mathematical Sciences Grants Program, Pacific Journal of Mathematics, Proceedings of the AMS, Transactions of the AMS, Transformation Groups.