

# ANDREI CĂLDĂRARU

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2817 Van Hise Ave.  
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**AREAS OF INTEREST**

**Algebraic Geometry, String Theory, Homological Algebra**

**POSITIONS HELD****Vilas Associate Research Professor**

*Named professor, University of Wisconsin-Madison, WI*

2020-2022

**Professor**

*University of Wisconsin-Madison, WI*

2012---present

**Visiting Invited Professor**

*Max Planck Institute for Mathematics, Bonn, Germany*

Fall 2012

**Tenured Associate Professor**

*University of Wisconsin-Madison, WI*

2008---2012

**Tenure Track Assistant Professor**

*University of Wisconsin-Madison, WI*

2005---2008

**NSF Postdoctoral Fellow/University Lecturer**

*University of Pennsylvania, Philadelphia, PA*

2002---2005

**EDUCATION****Ph.D. (Mathematics)**

*Cornell University, Ithaca, NY*

Areas of interest: algebraic geometry, string theory.

May 2000

**Master of Science (Computer Science)**

*Cornell University, Ithaca, NY*

Concentrations: theoretical computer science and cryptography.

May 2000

**Bachelor of Science (Mathematics and Computer Science)**

*Hebrew University, Jerusalem, Israel*

Graduated Summa Cum Laude with a double major in mathematics and computer science.

July 1993

**PH. D. THESIS****Derived categories of twisted sheaves on Calabi-Yau manifolds**

*(Cornell University, 2000)*

*Thesis advisor: Dr. Mark Gross (currently Professor at Cambridge University, England)*

<b>AWARDS</b>	<b>NSF Research Grant 2202365 (\$150,000)</b>	2022—2025
	<b>NSF Focused Research Groups Grant 2152088 (\$341,413)</b> <i>Collaborative research between UW-Madison, University of Chicago, Northwestern University, University of California-Berkeley, and University of Washington-Seattle</i>	2022—2025
	<b>Vilas Associate Research Professorship (\$75,000)</b> <i>Named professorship.</i>	2020—2022
	<b>NSF Research Grant 1811925 (\$250,000)</b>	2018—2022
	<b>University of Wisconsin Graduate School Grant (\$23,466)</b> <i>Provides summer salary and graduate student support</i>	2018
	<b>Short term visitor, Institute for Advanced Studies</b> <i>“Homological Mirror Symmetry” special year program.</i>	Fall 2016
	<b>Honorary foreign member, Geometry and Physics group</b> <i>GAP group of the Romanian Academy of Sciences</i>	Fall 2015—present
	<b>University of Wisconsin Graduate School Grant (\$17,000)</b>	Summer 2016
	<b>NSF Research Training Groups Grant 1502553 (\$2,000,000)</b> <i>Algebraic Geometry, Number Theory and Applied Algebra</i> <i>co-PI with Nigel Boston.</i>	2015-2020
	<b>NSF Research Grant 1200721 (\$220,178)</b>	2012—2018
	<b>NSA Mathematical Sciences Program</b> <i>Standard Research Grant (awarded, unable to accept due to conflict with NSF).</i>	2012
	<b>NSF Research Training Groups Grant 0838210 (\$1,297,349)</b> <i>Algebraic Geometry and Number Theory at the University of Wisconsin</i> <i>co-PI with Jordan Ellenberg.</i>	2011-2014
	<b>NSF Research Grant 0901224 (\$216,342)</b>	2009-2012
	<b>University of Wisconsin Graduate School Grant</b> <i>Research grant (awarded, unable to accept due to conflict with NSF).</i>	2009
	<b>NSF Research Grant 0556042 (\$257,926)</b>	2006-2009
	<b>NSF Postdoctoral Research Fellowship 0202567 (\$108,000)</b>	2002-2005
	<b>Intel Prize</b> <i>Awarded to outstanding students at the Hebrew University.</i>	Summer 1993
	<b>Amirim Fellowship</b> <i>Hebrew University, Jerusalem, Israel</i>	1991-1993
	<b>Silver Medal, International Computer Science Olympiad</b> <i>Part of Romania’s team at the second International Computer Science Olympiad held in Minsk, U.S.S.R.</i>	Spring 1990

## PUBLICATIONS

- 1. On the foundations of categorical enumerative invariants**  
(with Junwu Tu), 77pp, final revisions
- 2. Effective algorithms for enumerating ribbon graphs**  
to be submitted to SIAGA
- 3. The  $g=2$  categorical Gromov-Witten invariants of elliptic curves**  
(with Weng-Him Cheung and Yunfan He), in preparation
- 4. On the cohomology of the Bridgeland differential**  
(with Dima Arinkin), in preparation
- 5. An HKR decomposition for Azumaya orbifolds**  
(with Dima Arinkin), in preparation
- 6. Moonshine at Landau-Ginzburg points**  
(with Yunfan He and Shengyuan Huang), submitted, (arXiv:2107.12405), 7pp
- 7. The cup product in orbifold Hochschild cohomology**  
(with Shengyuan Huang), submitted (arXiv:2101.06276), 33pp
- 8. Categorical enumerative invariants, I: string vertices**  
(with Kevin Costello and Junwu Tu), submitted, (arXiv:2009.06673), 35pp
- 9. Categorical enumerative invariants, II: Givental formula**  
(with Junwu Tu), submitted, (arXiv:2009.06659), 55pp
- 10. Categorical primitive forms and Gromov-Witten invariants of  $A_n$  singularities**  
(with Si Li and Junwu Tu), Internat. Math. Res. Notices, rnz315 (2019)
- 11. Computing a categorical Gromov-Witten invariant**  
(with Junwu Tu), Compos. Math. 156 (2020), no. 7, 1275-1309
- 12. On intersections of two Grassmannians in  $\mathbb{P}^9$**   
(with Lev Borisov and Alex Perry), J. reine angew. Math., doi:10.1515/crelle-2018-0014
- 13. GLSM realizations of maps and intersections of Grassmannians and Pfaffians**  
(with Johanna Knapp and Eric Sharpe), J. High Energ. Phys. (2018) 2018: 119
- 14. Formality of derived intersections and the orbifold HKR isomorphism**  
(with Dima Arinkin and Márton Hablicsek), J. Algebra (2019), (arXiv:1412.5233), 23pp
- 15. The Hodge theorem as a derived self-intersection**  
(with Dima Arinkin and Márton Hablicsek) Algebraic Geometry 4 (2017), 394-423
- 16. On the Lie algebroid of a derived self-intersection**  
(with Damien Calaque and Junwu Tu), Adv. in Math. 262 (2014), 751-783
- 17. Curved  $A_\infty$  algebras and Landau-Ginzburg models**  
(with Junwu Tu), New York J. Math. 19 (2013), 305-342
- 18. PBW for an inclusion of Lie algebras**  
(with Damien Calaque and Junwu Tu), J. Algebra 378 (2013), 64-79
- 19. When is the self-intersection of a subvariety a fibration?**  
(with Dima Arinkin), Adv. in Math., 231 (2012), no. 2, 815-842
- 20. Non-birational twisted derived equivalences in abelian GLSMs**  
(with Jacques Distler, Simeon Hellerman, Tony Pantev and Eric Sharpe)  
Communications in Mathematical Physics 294 (2010), no. 3, 605-645

**PUBLICATIONS  
(CONT'D)**

- 21. The Mukai pairing, I: a categorical approach**  
(with Simon Willerton), New York J. of Math., no. 16 (2010), 61-98
- 22. The Pfaffian-Grassmannian derived equivalence**  
(with Lev Borisov), J. Algebraic Geom. 18 (2009) 201-222
- 23. Non-birational Calabi-Yau threefolds that are derived equivalent**  
Internat. J. Math. 18 (2007), No. 5, 491-504
- 24. Derived categories: a skimming**  
Snowbird Lectures in Algebraic Geometry, Contemporary Math., no. 388 (2005), 43-75
- 25. The Mukai pairing, II: the Hochschild-Kostant-Rosenberg isomorphism**  
Adv. in Math., 194 (2005), no. 1, 34-66
- 26. The Mukai pairing, I: the Hochschild structure**  
preprint math.AG/0308079, superseded by paper 12. above
- 27. Algebraic deformations arising from orbifolds with discrete torsion**  
(with Anthony Giaquinto, Sarah Witherspoon)  
J. Pure Appl. Algebra, **187** (2004), no. 1-3, 51-70
- 28. D-Branes, B-fields, and Ext groups**  
(with Sheldon Katz, Eric Sharpe), Adv. Theor. Math. Phys., 7 (2003), no. 3, 381-404
- 29. Fiberwise stable bundles on elliptic fibrations with relative Picard number one**  
CR Acad. Sci. Paris Ser. I, 334 (2002), no. 6, 469-472
- 30. Non-fine moduli spaces of sheaves on K3 surfaces**  
Internat. Math. Res. Notices 2002 (2002), no. 20, 1027-1056
- 31. Derived categories of twisted sheaves on elliptic threefolds**  
J. reine angew. Math. (Crelle's Journal) 544 (2002), 161-179
- 32. Derived categories of twisted sheaves on Calabi-Yau manifolds**  
Ph.D. thesis, Cornell University (2000)

**PUBLICATIONS  
COMPLETED BY  
PH.D.**

**STUDENTS  
UNDER**

**SUPERVISION**

- 1. Weng-Him Cheung, Constructing the topological field theory associated to a cyclic  $A_\infty$  algebra**, preprint
- 2. Shengyuan Huang, Functoriality of HKR isomorphisms**, preprint, arXiv:2002.00017
- 3. Nicolas Addington, Spinor sheaves on singular quadrics**, Proc. Amer. Math. Soc. 139 (2011), no. 11, 3867-3879
- 4. Nicolas Addington, The Derived Category of the Intersection of Four Quadrics**, preprint arXiv:0904.1764
- 5. Junwu Tu, Matrix factorizations via Koszul duality**, preprint arXiv:1009.4151

<b>CONFERENCES ORGANIZED</b>	<b>AMS Sectional Meeting on Categorical Enumerative Invariants</b> (with Junwu Tu) <i>University of Wisconsin-Madison, Madison, WI</i>	September 2019
	<b>Categorical Gromov-Witten Invariants</b> (with R. Pandharipande and N. Sheridan) <i>ETH Zürich, Switzerland</i>	January 2019
	<b>Homological Methods in Algebraic Geometry</b> (with Dima Arinkin) <i>University of Wisconsin, Madison</i>	April 2014
	<b>Mirror Symmetry in the Midwest</b> (with Yong-Geun Oh) <i>University of Wisconsin, Madison</i>	November 2012
	<b>Midwest Algebraic Geometry Graduate Conference</b> <i>University of Wisconsin, Madison</i>	October 2010
<b>SELECTED INVITED LECTURES</b>	<b>Categorical and enumerative aspects of mirror symmetry (a tribute to the life and work of Professor Bumsig Kim)</b> <i>KLAS, Seoul, South Korea</i>	September 2022
	<b>String-Math</b> <i>University of Warsaw, Poland</i>	July 2022
	<b>Geometry of GLSMs</b> <i>University of Birmingham, England</i>	June 2022
	<b>Derived categories and moduli spaces</b> <i>Cornell University, Ithaca NY</i>	April 2022
	<b>Derived algebraic geometry</b> <i>BIRS, Banff, Canada</i>	November 2021
	<b>Categorical Enumerative Invariants (5 lectures)</b> <i>Imperial College, London, UK (online)</i>	September 2020
	<b>Higher structures in geometry and physics</b> <i>Fields Institute, Toronto, Canada</i>	November 2019
	<b>Geometry and algebra of Landau-Ginzburg models</b> <i>Fields Institute, Toronto, Canada</i>	September 2019
	<b>AMS Sectional meeting</b> <i>University of Wisconsin, Madison, WI</i>	September 2019
	<b>Algebraic Geometry seminar</b> <i>University of Edinburgh</i>	July 2019
	<b>Derived categories and geometry in positive characteristic</b> <i>IMPAN, Warsaw, Poland</i>	June 2019
	<b>Ninth congress of Romanian mathematicians</b> <i>Galati, Romania</i>	June 2019
	<b>Derived categories and related topics conference</b> <i>Sun-Yat Sen University, Guangzhou, China</i>	May 2019
	<b>AGNES (Algebraic Geometry in the Northeast)</b> <i>University of Massachusetts-Amherst</i>	March 2019
	<b>Categorical Gromov-Witten invariants (series of four lectures)</b> <i>ETH, Zürich, Switzerland</i>	January 2019

**INVITED  
LECTURES  
(CONT'D)**

<b>Algebraic Geometry seminars</b> <i>Stanford University, Virginia Tech University, Cornell University</i>	April-October 2018
<b>Spring School “Categorical Gromov-Witten invariants” (lead)</b> <i>Castello di Montegufoni, Italy</i>	March 2018
<b>Algebraic Geometry Seminar</b> <i>RIMS (Research Institute in Mathematical Sciences), Kyoto, Japan</i>	November 2017
<b>Math-String Seminar</b> <i>IPMU (Institute for the Physics and Mathematics of the Universe), Tokyo, Japan</i>	November 2017
<b>Algebraic Geometry Seminar</b> <i>Northwestern University, Evanston, IL</i>	November 2017
<b>AMS Sectional Meeting</b> <i>University at Buffalo, Buffalo, NY</i>	September 2017
<b>Enumerative Geometry, Mirror Symmetry, and Physics</b> <i>University of Illinois at Urbana-Champaign</i>	July 2017
<b>Symplectic Geometry Seminar</b> <i>Institute for Advanced Studies, Princeton, NJ</i>	April 2017
<b>Winter school “Higher Categories and TQFT” (primary lecturer)</b> <i>KLAS, South Korea</i>	December 2016
<b>I-70 Algebraic Geometry Symposium (plenary speaker)</b> <i>University of Missouri, Columbia</i>	November 2016
<b>Workshop on String/M-theory</b> <i>Fields Institute, Toronto, Canada</i>	August 2016
<b>Interacting Algebraic Geometry</b> <i>Institut de Mathématiques de Bourgogne, Dijon, France</i>	July 2016
<b>Factorization Algebras and Functorial Field Theory</b> <i>Mathematisches Forschungsinstitut Oberwolfach, Germany</i>	May 2016
<b>Algebraic Geometry seminar</b> <i>Northeastern University, Boston, MA</i>	November 2015
<b>AMS Sectional Meeting</b> <i>Loyola University, Chicago, IL</i>	October 2015
<b>AMS Summer Institute in Algebraic Geometry</b> <i>University of Utah, Salt Lake City, UT</i>	July 2015
<b>Eighth Congress of Romanian Mathematicians</b> <i>Iasi, Romania</i>	July 2015
<b>GAP XIII, Derived Geometry conference</b> <i>IBS Center for Geometry and Physics, Pohang, Korea</i>	July 2015
<b>Algebraic Geometry seminar</b> <i>Hebrew University, Jerusalem, Israel</i>	June 2015
<b>Spring Eastern regional AMS conference</b> <i>Georgetown University, Washington, DC</i>	March 2015

**INVITED  
LECTURES  
(CONT'D)**

<b>Mathematics Inspired by String Theory</b> <i>Tsinghua Sanya Mathematical Forum, Sanya, China</i>	December 2014
<b>Higher Structures in Philadelphia conference</b> <i>Temple University, Philadelphia, PA</i>	August 2014
<b>Algebraic Geometry Summer Days</b> <i>Institute of Mathematics of the Romanian Academy, Bucharest, Romania</i>	June 2014
<b>Deformation Theory and Topology seminars</b> <i>University of Pennsylvania and New York University</i>	April 2014
<b>Geometry Seminar</b> <i>University of British Columbia, Vancouver, Canada</i>	March 2014
<b>Algebraic Analysis and Deformation Quantization conference</b> <i>University of Padova, Padova, Italy</i>	February 2014
<b>Higher Categories and Topological Field Theories conference</b> <i>Erwin Schrödinger Institute, Vienna, Austria</i>	June 2013
<b>Moduli Spaces and their Invariants in Mathematical Physics</b> <i>Centre de Recherche Mathématiques, Montréal, Canada</i>	June 2013
<b>Cornell-PSU Symplectic Geometry seminar</b> <i>Penn State University, State College, PA</i>	April 2013
<b>Various Geometry Seminars</b> <i>ETH Zurich, EPFL Lausanne, Oxford University, Max Planck Institute Bonn, University of Amsterdam, IMAR Bucharest</i>	Sept-Dec 2012
<b>Szygies in Algebraic Geometry, with an exploration of a Connection with String Theory</b> <i>Banff International Research Station, Banff, Canada</i>	August 2012
<b>Spring School on Algebraic Microlocal Analysis</b> <i>Northwestern University, Evanston, IL</i>	May 2012
<b>Colloquium and Algebra Seminar</b> <i>University of Maryland, College Park, MD</i>	May 2012
<b>Conference in Honor of Ragnar-Olaf Buchweitz</b> <i>University of Syracuse, Syracuse, NY</i>	April 2012
<b>Hyperkahler and holomorphic symplectic geometry</b> <i>BIRS, Banff, Canada</i>	March 2012
<b>Algebraic Geometry Seminar</b> <i>Princeton University, Princeton, NJ</i>	February 2012
<b>Algebraic Analysis Seminar</b> <i>Université Paris 7, Paris, France</i>	November 2011
<b>Mirror Symmetry in the Midwest</b> <i>Kansas State University, Manhattan, KS</i>	November 2011
<b>Colloquium and Algebraic Geometry Seminar</b> <i>University of Utah, Salt Lake City, UT</i>	October 2011
<b>Seventh International Congress of Romanian Mathematicians</b> <i>Brasov, Romania</i>	August 2011

<b>INVITED LECTURES (CONT'D)</b>	<b>The Legacy of Deformation Quantization</b> <i>ETH, Ascona, Switzerland</i>	July 2011
	<b>Loop Algebras, Groups, and Spaces</b> <i>CIRM Luminy, Marseille, France</i>	June 2011
	<b>Colloquium and Algebraic Geometry Seminar</b> <i>University of North Carolina, Chapel Hill, NC</i>	March 2011
	<b>Western Algebraic Geometry Seminar</b> <i>University of Arizona, Tucson, AZ</i>	November 2010
<b>GRADUATE AND POSTDOC ADVISING</b>	<b>Graduate Students</b>	
	<p>Nicolas Addington – Ph.D. received 12/2009, Associate Professor, University of Oregon  Junwu Tu – Ph.D. received 08/2011, Professor, ShanghaiTech University, Shanghai, China  Márton Hablicsek – Ph.D. received 06/2014, tenure-track professor, University of Leyden  Ahmet Kabakulak – Ph.D. received 06/2017, currently at Amazon.com  Shengyuan Huang – Ph.D. received 06/2021, post-doc, University of Birmingham  David Wagner – Ph.D. received 06/2021  Weng-Him Cheung – Ph.D. received 08/2022  Yunfan He – Ph.D. expected 06/2023</p>	
	<b>Postdocs Advised and Current Position</b>	
	<p>Sukhendu Mehrotra (2009-2011), Professor, Chennai Mathematical Institute  Matthew Ballard (2011-2013), Associate Professor, University of South Carolina  Parker Lowrey (UW-Madison, 2013-2014), Senior Data Scientist, Activision  Alexander Pavlov (2016-2018)  Michael Brown (2017-2020), tenure-track Auburn University, Auburn, AL</p>	
<b>TEACHING EXPERIENCE</b>	<b>Lecture Series: Categorical enumerative invariants</b> <i>Imperial College, London, UK</i> Five lecture series presenting recent progress in the theory of categorical enumerative invariants.	September 2020
	<b>Lead Lecturer: Categorical Gromov-Witten invariants</b> <i>Castello di Montegufoni, Italy (organized by the University of Mainz)</i> Along with Timothy Perutz, presented a five lecture series aimed at post-doctoral fellows and graduate students.	March 2018
	<b>Lecture Series: Gromov-Witten Invariants of <math>A_\infty</math> Categories</b> <i>Chinese University of Hong Kong, Hong Kong</i> Presented a six lecture series aimed at post-doctoral fellows and graduate students.	January 2010
	<b>Instructor</b> <i>University of Pennsylvania summer school on Geometry of Quantum Fields And Strings</i> One of the primary instructors for the summer school, which was aimed at introducing graduate students and post-doctoral fellows to advanced topics in string theory and mirror symmetry	June 2009
	<b>Instructor</b> <i>University of Utah summer school on Derived Categories</i> One of the primary instructors for the summer school, which was aimed at introducing graduate students and post-doctoral fellows to advanced topics in derived categories and physics	June 2007



**TEACHING  
EXPERIENCE  
(CONT'D)**

**Lead Instructor**

2004

*Lukecin fall school for advanced graduate students*

One of two principal lecturers at the school, presenting six lectures introducing graduate students to current areas of research

**SERVICE**

**Organizer**

Algebraic Geometry Seminar – UW-Madison (2005 – present)

Putnam Club – UW-Madison 2009-2010

**NSF Panel member**

Evaluating proposals submitted to the NSF Algebra Section – 2008-2011, 2014, 2019-2020; Career proposals October 2017.

**Referee**

Various journals, including *Inventiones Mathematicae*, *Duke Mathematical Journal*, *Advances in Mathematics*, *Communications in Mathematical Physics*

**Committee Member (UW-Madison)**

Physical sciences divisional committee – 2013-2016, fall 2017, fall 2022

University senator – 2010-2012

Salary committee – 2013, 2014-2017 (chair), 2020-2021 (chair)

Ad-hoc salary committee 2021-2022 (chair)

Awards committee – 2018-2019 (chair)

Budget committee – 2017-2018

Algebra caucus chair – 2014

Undergraduate program committee – 2005-2008

TA evaluation committee – 2011-2012

Director of computing search committee – 2011

Graduate and undergraduate advisor – 2011-2020

Graduate admissions committee – 2019-present