

VITA
Sheldon Katz

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Education

S.B. 1976 Massachusetts Institute of Technology (Mathematics)
Ph.D. 1980 Princeton University (Mathematics)

Professional Experience

University of Illinois	Professor	2001–
	Arthur Coble Scholar, Department of Mathematics	2021–2023
	Dean's Special Advisor, College of LAS	2018–
	Interim Chair, Department of Mathematics	Fall 2017
	Chair, Department of Mathematics	2006–2011
Oklahoma State University	Regents Professor	1999–2002
	Southwestern Bell Professor	1997–1999
	Professor	1994–2002
	Associate Professor	1989–1994
	Assistant Professor	1987–1989
University of Oklahoma	Assistant Professor (<i>tenure 1987</i>)	1984–1987
University of Utah	Instructor	1980–1984

Visiting Positions

SLMath	Member	2024
ETH Zürich	Visitor	2024
MSRI	Simons Visiting Professor	2018
Simons Center		2012
Mittag-Leffler Institute, Sweden	Visiting Professor	1997
Duke University	Visiting Professor	1991–1992
University of Bayreuth, West Germany	Visiting Professor	1989
Institute for Advanced Study	Member	1982–1983

Publications

1. Degenerations of quintic threefolds and their lines. *Duke Math. Jour.* **50** (1983), 1127–1135.
2. Lines on complete intersection threefolds with $K=0$. *Math. Z.* **191** (1986), 297–302.
3. Tangents to a multiple plane curve. *Pac. Jour. Math.* **124** (1986), 321–331.

4. On the finiteness of rational curves on quintic threefolds. *Comp. Math.* **60** (1986), 151–162.
5. Hodge numbers of linked surfaces in \mathbf{P}^4 . *Duke Math. Jour.* **55** (1987), 89–95.
6. The cubo-cubic transformation of \mathbf{P}^3 is very special. *Math. Z.* **195** (1987), 255–257.
7. Iteration of Multiple point formulas and applications to conics. *Proceedings of the Algebraic Geometry Conference, Sundance, UT 1986, SLN 1311*, 147–155.
8. Varieties cut out by quadrics: Scheme theoretic versus homogeneous generation of ideals (with L. Ein and D. Eisenbud). *Proceedings of the Algebraic Geometry Conference, Sundance, UT, 1986, SLN 1311*, 51–70.
9. The genus of the intersection curve of two rational surface patches (with T. Sederberg). *Computer Aided Geometric Design* **5** (1988), 253–258.
10. Cremona transformations with smooth irreducible fundamental locus (with B. Crauder). *Amer. Jour. Math.* **111** (1989), 289–307.
11. T.W. Sederberg, H.N. Christiansen, S. Katz. An improved test for closed loops in surface intersections. *Computer Aided Geometric Design* **21** (1989), 505–508.
12. Lines on the Fermat quintic threefold and the infinitesimal generalized Hodge conjecture (with A. Albano). *Trans. AMS* **324** (1991) 353–368.
13. Small resolutions of Gorenstein Threefold Singularities. *Contemp. Math.* **116** (1991) 61–70.
14. Cremona transformations and Hartshorne’s conjecture (with B. Crauder). *Amer. Jour. Math.* **113** (1991) 269–285
15. Discriminants and limits of duals of plane curves. *Contemp. Math.* **123** (1991) 99–106.
16. Cremona transformations and syzygies (with K. Hulek and F.-O. Schreyer). *Math. Z.* **209** (1992) 419–443.
17. Gorenstein threefold singularities with small resolutions via invariant theory for Weyl groups (with D. Morrison). *J. Alg. Geom.* **1** (1992) 449–530.
18. Van Geemen’s families of lines on special quintic threefolds (with A. Albano). *Manus. Math.* **70** (1991) 183–188.
19. Recent Work on Cremona Transformations. In: *Free Resolutions in Commutative Algebra and Algebraic Geometry, Sundance 90*, 109–119. Jones and Bartlett Publishers, Boston 1992.
20. Rational curves on Calabi-Yau threefolds. *Essays on Mirror Manifolds*, 168–180. S.-T. Yau (ed.), International Press, Hong Kong 1992.
21. Arithmetically Cohen-Macaulay Curves Cut Out by Quadrics. In: *Computational Algebraic Geometry and Commutative Algebra*, D. Eisenbud and L. Robbiano (eds.), *Symposia Mathematica Volume XXXIV*, Cambridge University Press 1993, Pp. 257–263.
22. The desingularization of $\text{Hilb}^4\mathbf{P}^3$ and its Betti Numbers. In: *Zero Dimensional Schemes: Proceedings of the International Conference held in Ravello, June 8–13, 1992*. F. Orrechia, L. Chiantini (eds.), W. de Gruyter, Berlin, New York 1994.
23. Rational curves on Calabi-Yau manifolds: verifying predictions of Mirror Symmetry. In *Projective Geometry with Applications*, (E. Ballico, editor), 231–239, Marcel-Dekker 1994.

24. Mirror Symmetry for Two Parameter Models - I (with P. Candelas, X. de la Ossa, A. Font and D.R. Morrison). Nuclear Physics **B416** (1994) 481–538; Mirror Symmetry, II, Greene and Yau (eds.), 1996.
25. Mirror Symmetry for Two Parameter Models - II (with P. Candelas, A. Font and D.R. Morrison). Nuclear Physics **B429** (1994) 626–674.
26. Mirror symmetry for hypersurfaces in weighted projective space and topological couplings (with P. Berglund). Nuclear Physics **B420** (1994) 289–314.
27. Mirror Symmetry Constructions: A Review (with P. Berglund). In: “Mirror Symmetry II”, 87–113, Greene and Yau (eds.), AMS-IP Studies in Advanced Mathematics Vol. 1, 1997.
28. Mirror Symmetry for Calabi-Yau hypersurfaces in weighted \mathbf{P}^4 and extensions of Landau-Ginzburg theory (with P. Candelas and X. de la Ossa), Nuclear Physics **B450** (1995) 267–292.
29. Mirror Symmetry and the moduli space for generic hypersurfaces in toric varieties (with P. Berglund and A. Klemm). Nuclear Physics **B456** (1995) 153–204.
30. Gromov-Witten Invariants via algebraic geometry. Nuclear Physics **B** Proc. Supp. (1996).
31. Enhanced Gauge Symmetry in Type II String Theory (with D.R. Morrison and M.R. Plesser). Nuclear Physics **B477** (1996) 105–140.
32. New Higgs transitions between dual $N = 2$ string models (with P. Berglund, A. Klemm, and P. Mayr), Nuclear Physics **B483** (1997) 209–228.
33. Matter from geometry (with C. Vafa), Nuclear Physics **B497** (1997) 146–154.
34. Small instantons, del Pezzo surfaces and type I' theory (with M. Douglas and C. Vafa), Nuclear Physics **B497** (1997) 155–172.
35. Geometric engineering of quantum field theories (with A. Klemm and C. Vafa) Nuclear Physics **B497** (1997) 173–195.
36. Geometric engineering of $N = 1$ quantum field theories (with C. Vafa), Nuclear Physics **B497** (1997) 196–204.
37. Mirror symmetry and Exact Solution of 4D $N=2$ Gauge Theories I (with P. Mayr, C. Vafa), Adv. Theor. Math. Phys. **1** (1998) 53–114.
38. Enumeration of Nodal Genus 2 Plane Curves with Fixed Complex Structure (with Z. Qin and Y. Ruan). J. Alg. Geom. **7** (1998) 569–587.
39. M-theory, topological strings and spinning black holes (with A. Klemm and C. Vafa), Adv. Theor. Math. Phys. **3** (1999) 1445–1537.
40. Open string instantons and superpotentials, (with S. Kachru, A. Lawrence, and J. McGreevy), Phys. Rev. **D62** (2000) 026001.
41. Multiple covers and the integrality conjecture for rational curves in Calabi-Yau threefolds (with J. Bryan and N.C. Leung), Jour. Alg. Geom. **10** (2001) 549–568.
42. Lie groups, Calabi-Yau threefolds, and F-theory (with P. Aspinwall and D. Morrison), Adv. Theor. Math. Phys. **4** (2001) 95–126.
43. Mirror symmetry for open strings (with S. Kachru, A. Lawrence, and J. McGreevy), Phys. Rev. **D62** (2000) 126005, hep-th/0006047.
44. Virtual fundamental classes of zero loci (with D. Cox and Y.P. Lee), Advances in algebraic geometry motivated by physics (Lowell, MA, 2000), 157–166, Contemp. Math., **276**, Amer. Math. Soc., Providence, RI, 2001.

45. Enumerative geometry of stable maps with Lagrangian boundary conditions and multiple covers of the disc (with M. Liu), *Adv. Theor. Math. Phys.* **5** (2002) 1–49, math.AG/0103074.
46. F. Cachazo, S. Katz, and C. Vafa, Geometric Transitions and N=1 Quiver Theories, hep-th/0108120.
47. F. Cachazo, B. Fiol, K. Intriligator, S. Katz, and C. Vafa, A Geometric Unification of Dualities, *Nucl. Phys.* **B628** (2002) 3–78, hep-th/0110028.
48. Versal deformations and superpotentials for rational curves in smooth threefolds, In: *Cont. Math.* **312** (2002) 129–136.
49. S. Katz and E. Sharpe, D-branes, open string vertex operators, and Ext groups, *Adv. Theor. Math. Phys.* **6** (2002) 979–1030.
50. A. Caldararu, S. Katz, and E. Sharpe, D-branes, B fields, and Ext groups, hep-th/0302099, *Adv. Theor. Math. Phys.* **7** (2003) 381–405
51. D-branes, orbifolds, and Ext groups, (with T. Pantev and E. Sharpe), hep-th/0212218, *Nucl. Phys.* **B673** (2003) 263–300
52. Spectra of D-branes with Higgs vevs, (with R. Donagi and E. Sharpe), *Adv. Theor. Math. Phys.* **8** (2005) 815–860, hep-th/0309270.
53. B-branes and the Derived Category, *Quantum theory and symmetries*, 538–547, World Sci. Publ. Hackensack, NJ 2004, hep-th/0402059.
54. Notes on Certain (0,2) Correlation Functions (with E. Sharpe), *Comm. Math. Phys.* **262** (2006) 611–644, hep-th/0406226.
55. Gromov-Witten, Gopakumar-Vafa, and Donaldson-Thomas invariants of Calabi-Yau threefolds, *Cont. Math.* **401** (2006) 43–52, math.AG/0408266.
56. P. Aspinwall and S. Katz, Computation of Superpotentials for D-Branes, *Comm. Math. Phys.* **264** (2006) 227–253, hep-th/0412209.
57. Geometric Transitions, Flops and Non-Kähler Manifolds: II (with M. Becker, K. Dasgupta, A. Knauf, and R. Tatar), *Nucl. Phys.* **B738** (2006) 124–183, hep-th/0511099.
58. Gauge-Gravity Dualities, Dipoles and New Non-Kähler Manifolds (with K. Dasgupta, M. Grisar, R. Gwynn, A. Knauf, and R. Tatar), *Nucl. Phys.* **B755** (2006) 21–78, hep-th/0605201.
59. On certain moduli spaces of ideal sheaves and Donaldson-Thomas invariants (with W.-P. Li and Z. Qin), *Math Research Letters*, **14** (2007), 403–411, math.AG/0508133.
60. Dipole-Deformed Bound States and Heterotic Kodaira Surfaces (with K. Dasgupta, J. Guffin, and R. Gwyn), *Nucl. Phys.* **B769** (2007) 1–30, hep-th/0610001.
61. Genus zero Gopakumar-Vafa invariants of contractible curves. *J. Differential Geom.* **79** (2008), 185–195.
62. Deformed Quantum Cohomology and (0,2) Mirror Symmetry (with J. Guffin), *Jour. High Energy Phys.* **109** (2010), 109–135, arXiv:0710.2354.
63. Supersymmetric Configurations, Geometric Transitions and New Non-Kähler Manifolds (with F. Chen, K. Dasgupta, P. Franche, and R. Tatar), *Nucl. Phys.* **B852** (2011) 553–591, arXiv:1007.5316.
64. Tate’s algorithm and F-theory (with D. Morrison, S. Schäfer-Nameki, and J. Sully), *JHEP* **94** (2011) 1108; arXiv:1106.3854.
65. A Mathematical Theory of Quantum Sheaf Cohomology (with R. Donagi, J. Guffin, and E. Sharpe), *Asian J. Math* **18** (2014) 387–417, arXiv:1110.3751, 32 pages

66. Physical aspects of quantum sheaf cohomology for deformations of tangent bundles of toric varieties (with R. Donagi, J. Guffin, and E. Sharpe), *Adv. Theor. Math. Phys.* **17** (2013) 1255–1301, arXiv:1110.3752.
67. $(0, 2)$ Quantum Cohomology (with R. Donagi, J. Guffin, and E. Sharpe), *Proc. Symp. Pure Math* **85** (2012) 83–103.
68. The refined BPS index from stable pair invariants (with J. Choi and A. Klemm), *Comm. Math. Phys.* **328** (2014) 903–954, arXiv:1210.4403.
69. Weak Coupling, Degeneration and Log Calabi-Yau Spaces, (with R. Donagi and M. Wijnholt), *Pure Appl. Math. Quart.* **9** (2013)655–738, special volume dedicated to the memory of Andrey Todorov, arXiv:1212.0553.
70. T-branes and geometry (with Lara Anderson and Jonathan Heckman) *J. High En. Phys.* 2014, no. 5, 080, arXiv 1310.1931.
71. On the motivic stable pairs invariants of K3 surfaces (with A. Klemm and R. Pandharipande), in: *K3 Surfaces and Their Moduli*, Faber, Farkas, and van der Geer (eds.), *Prog. Math* **315**, Birkhäuser, arXiv:1407.3181.
72. Topological String on elliptic CY 3-folds and the ring of Jacobi forms (with Minxin Huang and Albrecht Klemm), *J. High En. Phys.* 10 (2015) 125–202, arXiv:1501.04891.
73. Elliptically fibered Calabi-Yau manifolds and the ring of Jacobi forms (with Minxin Huang and Albrecht Klemm), *Nuclear Phys.* **B898** (2015), 681–692.
74. $SU(N)$ transitions in M-theory on Calabi-Yau fourfolds and background fluxes (with H. Jockers, D.R. Morrison, and M.R. Plesser), *Comm. Math. Phys.* **351** (2017) 837–871, arXiv:1602.07693.
75. T-Branes at the Limits of Geometry (with L. Anderson, J. Heckman, and L. Schaposnik), *J. High Energ. Phys.* (2017) 2017: 58, arXiv:1702.06137.
76. On Geometric Classification of 5d SCFTs (with P. Jefferson, H.-C. Kim, and C. Vafa), *J. High Energ. Phys.* (2018) 2018: 103, [https://doi.org/10.1007/JHEP04\(2018\)103](https://doi.org/10.1007/JHEP04(2018)103).
77. Local BPS Invariants: Enumerative Aspects and Wall-Crossing (with J. Choi, M. van Garrel, and N. Takahashi), *IMRN* (2018) <https://doi.org/10.1093/imrn/rny171>.
78. Swampland constraints on 5D $N = 1$ supergravity, (with H.-C. Kim, H. Tarazi and C. Vafa), *J. High Energ. Phys.* 2020, 80 (2020). [https://doi.org/10.1007/JHEP07\(2020\)080](https://doi.org/10.1007/JHEP07(2020)080).
79. Log BPS numbers of log Calabi-Yau surfaces (with J. Choi, M. van Garrel, and N. Takahashi), *Trans. Amer. Math. Soc.* **374** (2021), 687–732.
80. Towards Refining the Topological Strings on Compact Calabi-Yau 3-folds Minxin Huang, Sheldon Katz, Albrecht Klemm arXiv:2010.02910, *J. High Energ. Phys.* 2021, 266 (2021). [https://doi.org/10.1007/JHEP03\(2021\)266](https://doi.org/10.1007/JHEP03(2021)266), 89 pages.
81. Sheaves of maximal intersection and multiplicities of stable log maps, Jinwon Choi, Michel van Garrel, Sheldon Katz, Nobuyoshi Takahashi, *Sel. Math. New Ser.* **27**, 61 (2021). 51 pages. <https://doi.org/10.1007/s00029-021-00671-0>. arXiv:1908.10906.
82. D-critical loci for local toric Calabi-Yau 3-folds (with Y. Shi), *Bull. Lond. Math. Soc.* (2022) <https://doi.org/10.1112/blms.12680>, arXiv:2108.13510.
83. Enumerative Geometry of the Mirror Quintic (with D.R. Morrison), *Pure Appl. Math. Quart.* **18** (2022) 1599–1619.

84. Dimensional Reduction of B-fields in F-theory (with W. Taylor), *Pure Appl. Math. Quart.* **18** (2022), 1621–1660.
85. Topological Strings on Non-Commutative Resolutions (with A. Klemm, T. Schimannek, and E. Sharpe), *Commun. Math. Phys.* **405**, 62 (2024), 87 pages, <https://doi.org/10.1007/s00220-023-04896-2>.
86. D-critical locus structure on the Hilbert schemes of some local toric Calabi-Yau threefolds (with Y. Shi), *Math. Res. Lett.* **31** (2024) 1493–1522.
87. Topologically nontrivial B-fields on nodal Calabi–Yau three-folds and hybrid GLSM (with Thorsten Schimannek), *Intl. J. Modern Physics A* (2024) <https://doi.org/10.1142/S0217751X24460035>
88. Local Gromov-Witten invariants of some simple normal crossing surfaces (with Sungwoo Nam), *Math. Res. Lett.* **32** (2025) 1521–1535.
89. New non-commutative resolutions of determinantal Calabi-Yau threefolds from hybrid GLSM (with Thorsten Schimannek), *Adv. Theor. Math. Phys.*, to appear.
90. Refined BPS numbers on compact Calabi-Yau threefolds from Wilson loops, with Minxin Huang, Albrecht Klemm, and Xin Wang, *Journal of High Energy Physics* 10.1007/JHEP08(2025)178.

Books

- Mirror Symmetry and Algebraic Geometry (with D. Cox), *Mathematical Surveys and Monographs* vol. **68**, 469 pages, American Mathematical Society, Providence RI 1999. Russian translation 2013.
- Enumerative Geometry and String Theory, *Student Mathematical Library* vol. **32**, American Mathematical Society, Providence RI, 2006. Japanese translation 2011.

Book Chapters

- Mirror symmetry (with K. Hori, A. Klemm, R. Pandharipande, R. Thomas, C. Vafa, R. Vakil and E. Zaslow). *Clay Mathematics Monographs*, American Mathematical Society, Providence, RI; Clay Mathematics Institute, Cambridge, MA, 2003.

Appendices

- Intersection theory over moduli spaces of degenerate instantons. Appendix to “Holomorphic anomalies in topological field theories” by M. Bershadsky, S. Cecotti, H. Ooguri, and C. Vafa. *Nuclear Physics* **B405** (1993) 279–304.
- Verification of Gopakumar-Vafa invariants. Appendix to “Solving the Topological String on K3 Fibrations” by B. Haghighat and A. Klemm, *Jour. High Energy Phys.* **1001** (2010) 9.
- Heterotic string and the duality group (with G. Oberdieck), appendix to “CHL Calabi–Yau threefolds: curve counting, Mathieu moonshine and Siegel modular forms” by J. Bryan and G. Oberdieck, *arXiv:1811.06102*, *Commun. Number Theory Phys.* **14** (2020), 785–862.

Volumes Edited

- (with R. Donagi, A. Klemm, and D.R. Morrison) String-Math 2012, Proc. Symp. Pure Math. **90**, AMS.

Recent Invited Lectures

1. The Hilbert scheme of a supermanifold of bosonic dimension 1, Super-Geometry and SuperModuli workshop, Simons Center for Geometry and Physics, March, 2023
2. Enumerative invariants of Calabi-Yau threefolds with torsion and noncommutative resolutions, Seminar in Real and Complex Geometry Seminar (by Zoom), Tel Aviv University, May 2023
3. Enumerative geometry of singular Calabi-Yau threefolds associated to hybrid GLSMs, GLSMs@30 workshop, Simons Center for Geometry and Physics, May, 2023
4. Stacky small resolutions of determinantal octic double solids and noncommutative Gopakumar-Vafa invariants, Harvard CMSA Algebraic Geometry in String Theory seminar, November, 2023
5. The generating function of Euler characteristics of Hilbert schemes of points on a supermanifold, ETHZ moduli seminar, February, 2024
6. Enumerative invariants of noncommutative Calabi-Yau threefolds, Algebraic Geometry Seminar, Beijing Institute of Mathematical Sciences and Applications (by Zoom), September, 2024
7. Enumerative invariants via Wilson Loops, Workshop: Recent Developments in Higher Genus Curve Counting, Simons Center for Geometry and Physics, February, 2025
8. Enumerative invariants via Wilson Loops, Geometry, Representation Theory, and Physics, IPMU, Tokyo, March, 2025
9. Gopakumar-Vafa invariants via Wilson loops, Derived Categories and Mirror Symmetry, University of Wisconsin, May, 2025
10. Stacky Small Resolutions of Nodal Calabi-Yau Threefolds, Brauer Classes, and, Noncommutative Gopakumar-Vafa Invariants, Workshop on Counting Invariants and Enumerative Geometry, Brin Mathematical Research Center, University of Maryland, September, 2025.
11. The reasonable effectiveness of physics in mathematics, Columbia Colloquium, November, 2025.

Grants

1. NSF Focused Research Group Grants, 2000–2010
2. NSF individual investigator grants, 1986–1989, 1993–1998, 2006–2025; AGEP supplement 2016–2018
3. Conference: Facets of Noncommutative Geometry, NSF, 2022–23
4. NSA Individual Investigator Grants, 1989–1992, 1996–2002, 2003–2005
5. Scientific Computing Research Environments in the Mathematical Sciences (co-PI), 1988–1990, 1993–1995, 1998–1999 NSF.

6. Special year in algebraic geometry, 1998–1999, American Institute of Mathematics.
7. Mountain West Algebraic Geometry Research Group. NSF, 1987–1996, co-PI's Rick Miranda (Colorado State University) and Bob Speiser (Brigham Young University).
8. Workshop on Mirror Symmetry, NSF, Division of Theoretical Physics, 1995.
9. Special Year in Algebraic Geometry, NSF 1994–1995.
10. Research Experiences for Undergraduates, NSF 1993–1995.

Selected Professional Service

1. Member at Large, Mathematics Section Committee, American Association for the Advancement of Science, 2024–2025
2. Organizing Committee, Recent Developments in Higher Genus Curve Counting, Simons Center for Geometry and Physics, 8 week program January–February, 2025.
3. Scientific Advisory Board, Simons Center for Geometry and Physics, 2021–2027
4. Steering Committee, annual String Math conference series, 2010–
5. Mathematics Section Committee, American Association for the Advancement of Science, 2012–2016
6. External reviewer, University of Texas Department of Mathematics, 2013; 2020
7. External reviewer, University of Toronto Department of Mathematics, 2013
8. Committee of Visitors, NSF/DMS, 2013
9. AMS Nominating Committee 2008–2011 (Chair 2009–2010)
10. MSRI Committee on Trustees 2008–2009
11. AMS Council 2005–2008
12. AMS Committee on Science Policy 2006–7 (chair 2007)
13. AMS Council Subcommittee on the AMS Fellows Program 2005–2006
14. Editorial Board, Advances in Theoretical and Mathematical Physics, 2003–2024

Academic Honors

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| 2021–2023 | Arthur Coble Scholar, University of Illinois |
| 2013 | Fellow, American Mathematical Society |
| 1999–2002 | Regents Professor, Oklahoma State University |
| 1997–1999 | Southwestern Bell Professor, Oklahoma State University |
| 1973 | First Place, USA Math Olympiad |

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