# Douglas Ulmer

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## Education

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| Brown University, Ph.D., Mathematics. Advisor: B. H. Gross | 1983 – 1987 |
| Princeton University, A.B. *magna cum laude*, Mathematics | 1978 – 1982 |

## Employment

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| Professor and Head, Department of Mathematics, University of Arizona | 2017 – |
| Professor, School of Mathematics, Georgia Institute of Technology | 2015 – 2017 |
| Professor and Chair, School of Mathematics, Georgia Institute of Technology | 2009 – 2015 |
| Assistant, Associate, Full Professor, Department of Mathematics, University of Arizona | 1991 – 2009 |
| Bateman Research Instructor, Department of Mathematics, California Institute of Technology | 1989 – 1991 |
| C.L.E. Moore Instructor, Department of Mathematics, Massachusetts Institute of Technology | 1987 – 1989 |

## Research interests

Algebraic geometry and number theory. More specifically, the arithmetic and geometry of curves, surfaces, and abelian varieties over finite fields, number fields, and function fields; rational points and algebraic cycles; the conjectures of Birch and Swinnerton-Dyer and of Tate. Advocacy for mathematics research and education at all levels.

## Refereed publications

Journal articles

1. Transversality of sections on elliptic surfaces with applications to elliptic divisibility sequences and geography of surfaces (with G. Urzúa), *Selecta Mathematica (N.S.)*, **28** (2022), Article number 25.

2. Every $BT_1$ group scheme appears in a Jacobian (with R. Pries), *Proceedings of the American Mathematical Society*, **150** (2021), 525–537.

3. On $BT_1$ group schemes and Fermat curves (with R. Pries), *New York Journal of Mathematics*, **27** (2021), 705—739.

4. Bounding tangencies of sections on elliptic surfaces (with G. Urzúa), *International Mathematics Research Notices*, **2021** (2021), 4768—4802.

5. Explicit arithmetic of Jacobians of generalized Legendre curves over global function fields (with L. Berger, C. Hall, R. Pannekoek, J. Park, R. Pries, S. Sharif, and A. Silverberg), *Memoirs of the American Mathematical Society*, **266** (2020), v+131 pp.

6. On the arithmetic of a family of twisted constant elliptic curves (with R. Griffon), *Pacific Journal of Mathematics*, **305** (2020), 597–640.

7. On the Brauer-Siegel ratio for abelian varieties over function fields, *Algebra and Number Theory*, **13** (2019), 1069–1120.

8. On the number of rational points on special families of curves over function fields (with J. F. Voloch), *New Zealand Journal of Mathematics*, **47** (2017), 1–7.
9. Rational curves on elliptic surfaces, *Journal of Algebraic Geometry*, **26** (2017), 357–377.
10. Arithmetic of Jacobians in Artin-Schreier extensions (with R. Pries), *Transactions of the American Mathematical Society*, **368** (2016), 8553–8595.
11. Conductors of $\ell$-adic representations, *Proceedings of the American Mathematical Society*, **144** (2016), 2291–2299.
12. Low-dimensional factors of superelliptic Jacobians (with T. Occhipinti), *European Journal of Mathematics*, **1** (2015), 279–285.
13. Explicit points on the Legendre curve III, *Algebra and Number Theory*, **8** (2014), 2471–2522.
14. Explicit points on the Legendre curve II (with Ricardo Conceição and Chris Hall), *Mathematical Research Letters*, **21** (2014), 261–280.
15. Explicit points on the Legendre curve, *Journal of Number Theory*, **136** (2014), 165–194.
16. On Mordell-Weil groups of Jacobians over function fields, *Journal of the Institute of Mathematics of Jussieu*, **12** (2013), 1–29.
17. Unboundedness of the number of rational points on curves over function fields (with Ricardo Conceição and Felipe Voloch), *New York Journal of Mathematics*, **18** (2012), 291–293.
18. Ranks of Jacobians in towers of function fields (with Yuri Zarhin), *Mathematical Research Letters*, **17** (2010), 637–645.
19. Jacobi sums, Fermat Jacobians, and ranks of abelian varieties over towers of function fields, *Mathematical Research Letters*, **14** (2007), 453–467.
20. $L$-functions with large analytic rank and abelian varieties with large algebraic rank over function fields, *Inventiones Mathematicae*, **167** (2007), 379–408.
21. Geometric non-vanishing, *Inventiones Mathematicae*, **159** (2005), 133–186.
22. Elliptic curves with large rank over function fields, *Annals of Mathematics*, **155** (2002), 295–315.
23. Slopes of modular forms and congruences, *Annales de L'Institut Fourier*, **46** (1996), 1–32. Corrigendum: same volume, p. 1519.
24. On the Fourier coefficients of modular forms II, *Mathematische Annalen* (2), **304** (1996), 363–422.
25. A construction of local points on elliptic curves over modular curves, *International Mathematical Research Notices*, No. 7 (1995), 349–363.
26. On the Fourier coefficients of modular forms, *Annales Scientifiques de l'Ecole Normale Supérieure* (4), **28** (1995), 129–160.
27. Curves of genus ten on K3 surfaces, (with Fernando Cukierman), *Compositio Mathematica*, **89** (1993), 81–90.
28. $p$-descent in characteristic $p$, *Duke Mathematical Journal*, **62** (1991), 237–265.
29. $L$-functions of universal elliptic curves over Igusa curves, *American Journal of Mathematics*, **112** (1990), 687–712.
30. On universal elliptic curves over Igusa curves, *Inventiones Mathematicae*, **99** (1990), 377–391.

Book chapters

31. Curves and Jacobians over Function Fields, in *Arithmetic Geometry over Global Function Fields*, Advanced Courses in Mathematics CRM Barcelona, Springer Basel, (2014), 281–337.
32. Park City lectures on Elliptic curves over function fields, in *Arithmetic of L-functions*, IAS/Park City Mathematics Series **18** (2011), 211–280.
33. Function fields and random matrices, in *Ranks of elliptic curves and random matrix theory*, London Mathematical Society Lecture Note Series, **341** (2007), 109–142.
34. Elliptic curves and analogies between number fields and function fields, in *Heegner Points and Rankin L-series*, MSRI Publications **49** (2004), 285–315.

Conference proceedings

35. On balanced subgroups of the multiplicative group (with Carl Pomerance), in *"Number Theory and Related Fields In Memory of Alf van der Poorten"*, (Springer Proceedings in Mathematics & Statistics **43**), (2013), 253–270.
36. Slopes of modular forms, *Contemporary Mathematics*, **174** (1994), 167–183.

## Work in progress

Preprints

37. $p$-torsion for unramified Artin–Schreier covers of curves (with Bryden Cais), 45 pages, `arXiv:2307.16346`

## Research grants

Sloan Foundation Doctoral Dissertation Fellowship (1986); NSF Individual Investigator Grants (1988, 1989, 1991, 1993, 1997, 2000, 2004, 2007); GT College of Sciences Faculty Development Grant (2016); Simons Collaboration Grants (2015, 2020)

## Conference and travel grants

NSF Conference Grant (2009); University of Arizona Foreign Travel Grants (1992, 1995, 1996, 2002, 2003); Bourse du Gouvernement Français (1992); NSF International Travel grant to Kyoto ICM (1990).

## Training and infrastructure grants

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| NSF MCTP training grant DMS 1344199, co-PI | $1,300,000 | 2014 – 2019 |
| NSF S-STEM graduate scholarship grant DUE 1060333, co-PI | $600,000 | 2011 – 2016 |
| NSF S-STEM graduate scholarship grant DUE 0728684, PI | $552,000 | 2007 – 2011 |
| NSF VIGRE training grant DMS 0602173, PI | $3,500,000 | 2006 – 2011 |
| NSF Infrastructure Grant DMS 0207478, PI | $544,380 | 2002 – 2005 |
| NSF Group Infrastructure Grant DMS 9709662, PI | $500,000 | 1997 – 2002 |

## Graduate students and postdocs

PhD students

Tommy Occhipinti, Lisa Berger, Geoffrey Cunningham

Master's students

Boonyarit Intiyot, Paul Baloun

Post-docs mentored

Arvind Suresh, Padmavathi Srinivasan, Kit Ho Mak, Saikat Biswas, Cetin Urtis, Mugurel Barcau, Shuzo Takahashi, Dennis Eichhorn, Carl Lienert, Antonios Broumas

## Teaching and mentoring

I have taught a variety of courses, from freshman calculus through advanced graduate courses. I have also sponsored many capstone and undergraduate research projects, reading courses, and other one-on-one work with students. My teaching was recognized at Georgia Tech with several "Thank a Teacher" certificates and mentions on the list of "Most Influential Professors" and at the University of Arizona by the Eller College of Business and Public Administration *Student Council Faculty Award* in 1999.

## Selected extramural service

Editorial

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| Editorial board, *Journal de Théorie des Nombres de Bordeaux* | 2014 – |
| Twenty-one reviews for *Mathematical Reviews* | 1992 – 2004 |
| At least 117 reviews of articles and books for a variety of journals and publishers. | 1991 – |

Organizational

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| Treasurer and Trustee, American Mathematical Society | 2021 – |
| Co-organizer of an NSF advisory workshop on "Networks" | April 2009 |
| Scientific organizer of an American Mathematical Society Special Session in Tucson | April 2007 |
| Organizer of the VIGRE Southwestern Network | 2006 – 2009 |
| Scientific organizer of an American Mathematical Society Special Session in Pisa | June 2002 |
| Director of the Southwestern Center for Arithmetical Algebraic Geometry | 1997 – 2006 |

Advisory panels and reports to funding agencies

Service on panels for or reports to: NSF, MSRI, Chinese Ministry of Education, University System of Georgia, University of North Carolina, American Matheamtical Society, European Research Council, French Agence Nationale de la Recherche, Fulbright Commission, Institute for Mathematics and its Applications, Irish Research Council, Israel Science Foundation, National Security Agency, Netherlands Organisation for Scientific Research (NWO), Polish National Science Foundation.

## Selected University service

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| Department of Geosciences Academic Program Review | March 2022 |
| Chemistry and Biochemistry Head Search Committee | 2020 – 2021 |
| HeadsUp Steering Committee | 2018 – 2021 |
| Associate Vice Provost for Academic Administration Search Committee | Spring 2019 |
| Program in Applied Mathematics Chair Search Committee | 2017 – 2018 |
| ADVANCE Chairs Workshop panelist | April 2013 |
| School of Computer Science Chair Search Committee | 2010 – 2011 |
| Fulbright Scholarship Selection Committee | October 2006 |
| Marshall Scholarship interviews | October 2006 |
| "What is Beauty?" Public lecture sponsored by *UA Presents* | October 2003 |
| Fulbright Scholarship Selection Committee | September 2003 |
| Goldwater Fellowship Committee | February 2001 |
| "Fermat's Last Theorem," Public Lecture, University of Arizona | August 1993 |