

Curriculum Vita

Thomas Henry Parker

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EDUCATION

Ph.D. in Mathematics, Stanford University, 1980

Thesis advisor: Shing-Tung Yau (currently at Harvard University)

ScB. in Mathematics, *summa cum laude*, Brown University, 1976.

EMPLOYMENT

- 1993 – Professor of Mathematics, Michigan State University.
 - 2001-2002 Member, Institute for Advanced Study.
 - 1988-1993 Associate Professor of Mathematics, Michigan State University.
 - 1984-1988 Assistant Professor of Mathematics, Brandeis University.
 - 1980-1984 Assistant Professor of Mathematics, Benjamin Pierce Lecturer on Mathematics, Harvard University.
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HONORS AND AWARDS

- 2014 J. S. Frame Teaching Award, Michigan State University Mathematics Department.
 - 2013 Fellow of the American Mathematical Society.
 - 2001-2002 Member, Institute for Advanced Study.
 - 1998 J. S. Frame Teaching Award, Michigan State University.
 - 1989 Invited Address, AMS Regional Meeting, Worcester, Ma.
 - 1982 Phi Beta Kappa Teaching Award, Harvard University.
 - 1980 American Mathematical Society Postdoctoral Fellowship.
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RESEARCH INTERESTS

My research is in geometric analysis and its connections with mathematical physics, including Gauge theory and with the theory of pseudo-holomorphic curves. This field involves intriguing combinations of ideas and techniques from several different fields, including algebraic geometry, differential geometry, topology, and partial differential equations. My recent work uses PDE and analysis methods to study Gromov-Witten invariants.

PhD STUDENTS

Current	Keshav Sutrave Zhe Zhang
2021	Woongbae Park, Post-doctoral Associate, University of Pittsburgh
2015	Akos Nagy, Visiting Assistant Professor, U.C. Santa Barbara.
2014	Manousos Maridakis, Hill Assistant Professor, Rutgers University 2014-2017, now in Greece.
2011	Kwangho Choi, Lecturer, Dongguk University, Korea.
2005	Jens Von Bergmann, independent software developer, Vancouver, Canada.
2001	Junho Lee, Associate Professor of Mathematics at Central Florida University.
1996	Eleny-Nicoleta Ionel, Professor of Mathematics at Stanford University.
1994	Liviu Nicolaescu, Professor of Mathematics at Notre Dame.

MATHEMATICS RESEARCH PAPERS

1. *Relating VFCs on thin compactifications* (with E. Ionel), Math. Annalen **375** (2019), 845-893.
2. *Thin compactifications and relative fundamental classes* (with E. Ionel), J. Symplectic Geometry, **17** (3) 2019, 703-752.
3. *The Gopakumar-Vafa formula for symplectic manifolds* (with E. Ionel), Annals of Math., **187** (2018), 1-64.
4. *Corrigendum: The symplectic sum formula for Gromov-Witten invariants*, arXiv:1510.06943
5. *Spin Hurwitz numbers and the Gromov-Witten invariants of Kähler Surfaces* (with Junho Lee), Comm. Analysis & Geometry, **21**, No. 5, (2013).
6. *An obstruction bundle relating Gromov-Witten invariants of curves and Kähler surfaces* (with Junho Lee), American J. of Math. **134** (2012), 453-506.
7. *A Structure Theorem for the Gromov-Witten Invariants of Kähler Surfaces* (with Junho Lee). J. Diff. Geom. **77** (2007), 483-513.
8. *Symplectic Gluing and Family Gromov-Witten Invariants* (with Junho Lee), in *Geometry and Topology of Manifolds*, H. Boden, et. al. editors., AMS (Fields Institute communications), (2005), 147-172.
9. *The Symplectic Sum Formula for Gromov-Witten Invariants* (with E. Ionel), Annals of Math. **159** (2004), 935-1025.
10. *What is a Bubble Tree?*, Notices of the A.M.S., June/July 2003, 666-667.
11. *Relative Gromov-Witten Invariants* (with E. Ionel), Annals of Math. **157** (2003), 1-52.
12. *Gromov Invariants and Symplectic Maps* (with E. Ionel), Math. Annalen, **314** (1999), 127-158.
13. *Compactified Moduli Spaces of Pseudo-holomorphic Curves*, in *Mirror symmetry III*, AMS/IP Stud. Adv. Math., 10, AMS, Providence, RI, (1999), 77-113.
14. *Gromov-Witten Invariants of Symplectic Sums* (with E. Ionel), Math. Res. Lett. **5** (1998), 563-576.

15. *Sharp Decay Estimates for Yang-Mills Fields* (with D. Groisser), Comm. in Analysis and Geometry, **5**, (1997), 439-474.
16. *The Gromov Invariants of Ruan-Tian and Taubes* (with E. Ionel), Math. Res. Lett. **4**, (1997) 521-532.
17. *Bubble Tree Convergence for Harmonic Maps*, J. Diff. Geom., **44**, (1996) 595-633.
18. *Equivariant Sobolev Theorems and Yang-Mills-Higgs Fields*, in *Global Analysis in Modern Geometry*, Publish or Perish, Houston, (1993), 33-72.
19. *Pseudo-Holomorphic Maps and Bubble Trees* (with J. Wolfson), Jour. of Geometric Analysis, **3** (1993) 63-98.
20. *A Morse Theory for Equivariant Yang-Mills*, Duke Math. Jour. **66** (1992) 337-356.
21. *Non-Minimal Yang-Mills Fields and Dynamics*, Invent. Math., **107** (1992) 397-420.
22. *Semiclassical Yang-Mills Theory I: Instantons* (with D. Groisser), Commun. Math. Phys., **135** (1990) 101-140.
23. *The Geometry of the Yang-Mills Moduli Space for Definite Manifolds* (with D. Groisser), J. Differential Geometry, **29** (1989) 499-544.
24. *The Riemannian Geometry of the Yang-Mills Moduli Space* (with D. Groisser), Commun. Math. Phys., **112** (1987) 663-689.
25. *The Yamabe Problem* (with J. M. Lee), Bulletin of the A.M.S., **17** (1987) 37-91.
26. *Invariants of Conformal Laplacians* (with S. Rosenberg), Jour. Diff. Geometry, **25** (1987) 199-222.
27. *Gauge Choice in Witten's Energy Expression*, Commun. Math. Phys., **100** (1985) 471-480.
28. *Conformal Fields and Stability*, Math. Zeit., **185** (1984) 305-319.
29. *On Witten's Proof of the Positive Mass Theorem* (with C. H. Taubes), Commun. Math. Phys., **84** (1982) 223-238.
30. *Gauge Theories on Four-Dimensional Riemannian Manifolds*, Commun. Math. Phys., **85** (1982) 563-602.

PREPRINTS

1. *A natural Gromov-Witten virtual fundamental class* (with Eleny Ionel), arXiv:1302.3472. **View.**
2. *Convergence of the heat flow for closed geodesics* (with Kwangho Choi). **View.**
3. *Heat Kernels and Geodesics.* **View.**

MATHEMATICS EDUCATION PUBLICATIONS

1. *Elementary Geometry for Teachers* (with S. Baldrige). Sefton-Ash Publishing, 2008.
A 258 page textbook for the second semester of a course using the *Elementary Mathematics for Teachers* textbook below.

2. *A Study of Core-Plus Students Attending Michigan State University* (with R. O. Hill), American Math. Monthly, **113** (2006), 905-921.
3. *Elementary Mathematics for Teachers* (with S. Baldrige). Sefton-Ash Publishing, 2004.
A 234 page textbook for a “Mathematics for Elementary School Teachers” course taught in a mathematics department; used in conjunction with the Primary Mathematics textbooks from Singapore.
4. *The State of State MATH Standards 2005* by D. Klein with B. Braams, T. Parker, W. Quirk, W. Schmid, and W. S. Wilson and analysis by J. Torres. Thomas Fordham Foundation, Washington, DC. 2005.
This book is a review of the state mathematics standards for 49 states as they existed in fall 2004, as evaluated by mathematicians.

GRANTS

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| 2010-2015 | NSF research grant: <i>Global Analysis for Pseudo-holomorphic and Harmonic Maps</i> , (\$126K), PI 100%. (2 extensions) |
| 2010-11 | NSF grant supplement to the CCLI grant listed below, (\$16K), PI 100%. |
| 2008-2011 | NSF Research Training Grant: <i>Research Training in Geometry and Topology at Michigan State University</i> (joint with Fintushel, Kalfagianni, and Wolfson), (\$584K), coPI 25%. |
| 2008-2010 | NSF CCLI grant: <i>Collaborative Research: Elementary Mathematics for Teachers</i> (paired with grant to S. Baldrige at Louisiana State University), (\$150K), PI 100%. |
| 2007-2008 | NSF research grant supplement: <i>Analytic Studies on Pseudo-holomorphic Maps at Michigan State University</i> , (\$24K), PI 100%. |
| 2005-2008 | NSF Research Training Grant supplement: <i>Research Training in Geometry and Topology at Michigan State University</i> , (\$40K), coPI 25%. |
| 2004-2007 | NSF research grant: <i>Analytic Studies on Pseudo-holomorphic Maps</i> (\$140K), PI 100%. |
| 2004-2008 | NSF Research Training Grant, <i>Research Training in Geometry and Topology at Michigan State University</i> (joint with Fintushel, Kalfagianni, and Wolfson), (\$600K), coPI 25%. |
| 2001-2004 | NSF research grant: <i>Studies on Pseudo-holomorphic Maps</i> (\$188K), PI 100%. |
| 2001-2002 | Member, Institute for Advanced Study (housing and \$40K support). |
| 1998-2001 | NSF research grant: <i>Analysis of J-holomorphic Curves</i> (\$63K), PI 100%. |
| 1996-1998 | NSF research grant: <i>Analytic Aspects of Pseudo-holomorphic Curves</i> (\$43K), PI 100%. |
| 1993-1995 | NSF research grant: <i>Geometry of Moduli Space</i> (\$40K), PI 100%. |
| 1990-1992 | NSF research grant: <i>Geometric Yang-Mills Theory</i> (\$43K), PI 100%. |
| 1988-1990 | NSF research grant: <i>Differential Geometric Problems related to Mathematical Physics</i> (\$37K), PI 100%. |

- 1986-1988 NSF research grant: *Differential Geometric Problems related to Mathematical Physics* (\$32K), PI 100%.
- 1985-1986 NSF research grant extension: *General Relativity, Yang-Mills Theory and Minimal Submanifolds* (\$13K), PI 100%.
- 1982-1985 NSF research grant: *General Relativity, Yang-Mills Theory and Minimal Submanifolds* (\$23K), PI 100%.
- 1981-1982 AMS Postdoctoral Fellowship

MATHEMATICS EDUCATION: NATIONAL COMMITTEE AND REVIEW WORK

- Member, Fordham Foundation State Standards Study 2005 — a group of mathematicians that reviewed the K-12 mathematics standards for 49 states and wrote the book listed above.
- Member, Math-Science Initiative Support Project. This committee of mathematicians, supported by a U.S. Dept of Education grant, advised R. J. Milgram (the Stanford Topologist) in writing a document outlining the teaching of ‘Mathematics for Elementary School Teachers’ courses to be taught in Mathematics Departments.
- Member, AMS subcommittee formed to review the MET (“Mathematical Education of Teachers”) document 2000-01.

INVITED RESEARCH TALKS

- *Holomorphic curves, string theory and the GV conjecture*, Colloquium, University of Waterloo, Oct. 2016.
- *Holomorphic curves, string theory and the GV conjecture*, Colloquium, Louisiana State University, Feb. 2016.
- *Holomorphic curves, string theory and the GV formula*, Colloquium, Stanford University, Oct. 2015.
- *Holomorphic curves, string theory and the GV formula*, Colloquium, Rutgers University, April 2015.
- *Construction of the virtual fundamental class*, Workshop on moduli spaces of pseudo-holomorphic curves, Simons Center, Stony Brook, March 2014.
- *Holomorphic curves, string theory and a proof of the GV conjecture*, Colloquium, Central Florida University, Nov. 2013.
- *The Gopakumar-Vafa Conjecture for symplectic manifolds*, Berkeley-Stanford joint Geometry and Topology seminar, Stanford University, Oct. 2013.
- *Concentrating Eigenfunctions and Spin Hurwitz Numbers*, Geometry Seminar, University of Notre Dame, Dec 2012.
- *Spaces of Maps with varying domains and GW moduli spaces*, Symplectic Geometry Seminar, Stanford University, May 2011.
- *Concentrating eigenfunctions and local GW invariants*, RTG Conference on Gromov-Witten Invariants, University of Michigan, Ann Arbor, April 2010.

- *Relating Gromov-Witten Invariants of curves and surfaces*, MSRI Program in Symplectic and Contact Topology, Oct. 2009.
- *Relating Gromov-Witten invariants of curves and surfaces*, Third Illinois-Indiana Symplectic Geometry Conference, Urbana-Champaign, March, 2009.
- *Geodesics and Heat Kernels*, Colloquium, Indiana University, Oct. 2008.
- *An Obstruction Bundle Relating Gromov-Witten Invariants of Curves and Kähler Surfaces*, Berkeley/Stanford joint geometry/topology seminar, Berkeley, May, 2008.
- *An Obstruction Bundle Relating Gromov-Witten Invariants of Curves and Kähler Surfaces*, AMS Meeting Baton Rouge, LA. March 2008.
- *PDEs and Bubble Tree Compactifications*, Colloquium, Central Florida University, March 2008.
- *Gromov-Witten Invariants via Deformations of Kähler Surfaces*, AMS meeting at Notre Dame, April 2006.
- *Gromov-Witten Invariants via Geometric Analysis*, Colloquium, Stanford University, March 2006.
- *A Structure Theorem for Gromov-Witten Invariants on Kähler Surfaces*, Geometry Seminar, University of Michigan, Feb 2006.
- *PDEs and Bubble Tree Compactifications*, Colloquium, Wayne State University, Nov 2005.
- *Gromov-Witten Classes and the Geometry of the Canonical Divisor*, Klein Geometry Seminar, Notre Dame, Nov 2004.
- *Generalized J-holomorphic Maps*, Conference on Frontiers of PDE and Dynamical Systems, Rutgers University, March 2003.
- *Bifurcations of J-Holomorphic Maps*, Geometric Analysis Seminar, Princeton University, April 2002.
- *Bifurcations of Holomorphic Curves*, Colloquium, Brooklyn Polytechnic University, March 2002.
- *Elliptic PDEs and Bifurcations of Holomorphic Curves*, Colloquium, Rutgers University, Feb 2002.
- *Genus Zero GW invariants for general symplectic manifolds*, Topology seminar, Princeton University, Nov. 2001.
- *Gromov-Witten Invariants of Symplectic Sums*, Institute for Advanced Study, Princeton, Nov. 2001.
- *Gromov-Witten Invariants for Symplectic Sums*, Workshop on Symplectic and Contact Topology, Fields Institute, Toronto, March 2001.
- *Symplectic Sums and Symplectic Invariants*, Ohio State Geometry-Topology Conference, Dec 1999.
- *Holomorphic Maps and Symplectic Manifolds*, Colloquium, University of Notre Dame, April 1999.
- *Gromov-Witten Invariants of Symplectic Sums*, AMS 1998 Summer Research Conference on Quantum Cohomology, Mt Holyoke College, July 1998.
- *Counting Rational Curves in the Rational Elliptic Surface*, AMS Conference, University of Milwaukee, Oct 1997.

- *Seiberg-Witten and Gromov Invariants*. Series of four talks, University of Florida, May 1997.
- *Gromov Invariants and Dynamics*, Colloquium, University of Michigan, Ann Arbor, Oct 1996.
- *Remarks on Symplectic Invariants*, AMS Conference, University of Hartford, March 1995.
- *Remarks on Symplectic Invariants*, C.R.M. Workshop on Complex Geometry and Mirror Symmetry, University of Montreal, April 1995.
- *Analytic Aspects of Gauge Theory*, minicourse (10 one-hour lectures), IMA summer school program on Geometry, University of Illinois, Urbana-Champaign, July 1994.
- *Energy loss during bubbling for harmonic maps* EPMG Workshop, the Geometry Center, University of Minnesota, May 1994.
- *Differential Forms on the Yang-Mills Moduli Space*, A.M.S. Meeting, Brooklyn, N.Y., April 1994.
- *Pseudo-holomorphic Maps and Bubble Tree Compactifications*, M.S.R.I. Geometry and Mathematical Physics Conference, Jan 1994.
- *Yang-Mills Fields and Dynamics*, Differential Geometry Conference, Fields Institute, Waterloo, Canada, Aug 1993.
- *Bubbles on Bubbles*, AMS Research Conference on Differential Equations of Conformal Geometry, University of Washington, Seattle, July 1993.
- *Non-Minimal Yang-Mills Fields*, Colloquium at University of Toledo, April 1993.
- *Yang-Mills-Higgs Fields on the Four-sphere*, A.M.S. Meeting, University of Southern California, Nov 1992.
- *Unstable Yang-Mills Fields and Dynamics* and *Bubbling for J-holomorphic Maps*, Colloquium and Seminar Rice University, Sept 1992.
- *A Morse Theory for Equivariant Yang-Mills*, Special Session on Variational Problems in Geometry, A.M.S. Summer Meeting, Orono Maine, August 1991.
- *Equivariant Connections and Unstable Yang-Mills Fields*, Conference of Bundles in Complex Differential Geometry, Idaho State University, March 1991.
- *Holomorphic Curves and Bubbles* and *Unstable Yang-Mills Fields and Dynamics*, Colloquium and Seminar, University of Illinois, Feb 1991.
- *The Geometry of the Yang-Mills Moduli Space*, AMS Summer Research Conference on Differential Geometry, UCLA, July 1990.
- *Unstable Yang-Mills Fields and Dynamics* and *Semiclassical Yang-Mills Theory*, California Institute of Technology, March 1990.
- *Dynamics and Yang-Mills Fields*, University of Michigan Geometry Seminar, Jan. 1990.
- *Dynamics and Yang-Mills Fields*, Purdue University, Nov. 1988.
- *Donaldson Invariants and Differential Forms*, Lehigh University, Feb. 1989.
- *The Yamable Problem*, University of Utah, March 1989.
- *Invariant Yang-Mills Fields*, Michigan State University Differential Geometry Conference, March 1989.
- *The Yang-Mills Moduli Space*, invited hour talk, AMS Regional Meeting, Worcester, MA, April 1989.

- *Geometric Aspects of ϕ^4 Theory on Riemannian Manifolds*, AMS Annual Meeting, Phoenix, AZ, Jan 1989.
- *The Yamable Problem*, University of California, Irvine, March 1988.
- *Relativity and the Positive Mass Theorem*, University of Oregon, March 1988.
- *The Yamable Problem and Positive Mass*, Colloquium at Michigan State University, Feb. 1988.
- *The Yamable Problem and the Positive Action Theorem*, University of Massachusetts, Amherst, Feb. 1988.
- *The Yamable Problem*, Colloquium at the University of Texas, Austin, Feb. 1988.
- *Donaldson theory: a geometric perspective*, Geometry and Physics seminar, MIT, Nov. 1987.
- *L^2 Geometry of Moduli Space*, Gauge theory seminar, Harvard University, Nov. 1987.

INVITED MATHEMATICS EDUCATION TALKS

- *A Focused Course on Elementary Mathematics for Teachers*, MSRI Workshop on “The Mathematical Knowledge for Teaching, May 2007.
- *Elementary Mathematics for Teachers: Using Singapore Materials to Teach Teachers*, 40th annual conference, Wisconsin Mathematics Council Annual Conference, Green Lake, WI, May 2, 2008.
- *Representations in K-8 Mathematics: Uses and Misuses*, at the MSRI Conference “The Mathematical Knowledge for Teaching,” Monterey, CA, May 2005.
- *Mathematics Courses for Elementary Mathematics Teachers*, talk given at the Education Policy Forum on “What teachers need to know: envisioning highly qualified mathematics teachers”, sponsored by The Education Policy Center at MSU, Washington, DC, June 2004.
- *Sequencing in Elementary Mathematics*, Core Knowledge National Conference, Atlanta, GA, March 2004.
- *A Focused Mathematics Course for Elementary Teachers*, Mathematics Department Teaching Seminar, University of Michigan, Ann Arbor, Feb 2004.
- Featured speaker at the conference “Mathematicians Writing for Elementary Teachers,” Ohio State University, Nov 2003.