

Christopher Thomas Woodward

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Employment

Rutgers University Department of Mathematics. July '98 – present. Professor of Mathematics and Director of Graduate Student Professional Development.

Simons Center for Geometry and Physics. Visiting Faculty. Spring '11.

Harvard University Department of Mathematics. July '96 – June '98. National Science Foundation Postdoctoral Fellow and Instructor.

Education

Massachusetts Institute of Technology. September '92 – May '96. Ph.D. in Mathematics (Symplectic Geometry) supervised by Prof. V. Guillemin received in June '96.

Emmanuel College, Cambridge University, England. October '91 – June '92. Certificate of Advanced Study, with Distinction, for Part III of the Math. Tripos, June '92.

Harvard College. September '87 – May '91. A.B. Summa cum Laude in Mathematics and Physics, June '91.

St. Louis University High School. September '83 – May '87. Diploma June '87.

Educational Involvement

Course Instructor: Calculus, Linear Algebra, Mathematical Reasoning, Abstract Algebra, Geometry for K-8 Teachers, Differential Geometry, Symplectic Geometry, Algebraic Topology, Pseudoholomorphic Curves, Junior/Senior Honors Seminar. New curriculum development for multivariable calculus, linear algebra, geometry for k-8 teachers, and mathematical reasoning.

Research supervisor for the doctoral research of David Duncan, '09 – present, Sushmita Venugopalan, '08 – present, Andreas Ott (ETH-Zurich), joint with D. Salamon, '07 – '10, Reza Rezadagan, '05 – '09, Sikimeti Ma'u, '04 – '08. Yuka Taylor, '01–'03.

Postdoctoral Mentor for Eduardo Gonzalez, '05 – '08. Matthew Leingang, Fall '00 - Spring '03.

Co-organizer for the Rutgers Topology/Geometry Seminar '00- '09, Geometry, Symmetry and Physics Seminar '09-'10, '11-present, Department Colloquium, September '04 – September '07.

Supervisor of Research Experiences for Undergraduates, '00, '02, '04, '05, '06, '08, '09, '10.

Research Interests

Symplectic geometry and relations with Lie theory, algebraic geometry, and mathematical physics.

Service to the Profession

Conference Co-organizer, Equivariant Gromov-Witten theory and symplectic vortices, CIRM (Luminy), July '09; Geometric analysis and mathematical physics, University of

Toronto, January '08. AMS Special Session on Schubert Calculus, Northeastern University, October '02. Symplectic Geometry and Microlocal Analysis, M.I.T., September '98.

Editor for Differential Geometry and Global Analysis, Transactions of the American Mathematical Society, February 2009 – present.

Associate Editor, *Selecta Mathematica*, January 2007 – present.

Honors and Awards

NSF Award DMS 0904358 in Geometric Analysis. “Gauged Gromov–Witten theory and holomorphic quilts” 7/01/09–6/31/12.

NSF Award DMS 0605097 in Geometric Analysis. “Holomorphic Curves and Two-Dimensional Gauge Theory”, 7/01/06–6/31/09.

NSF Career Award DMS 0093647 “Symplectic geometry, physics, and algebraic combinatorics” 9/01/01 – 08/31/06.

Rutgers Board of Trustees Research Fellowship for Scholarly Excellence, '02.

NSF Award DMS 9971357 “Moduli spaces of flat connections and Hamiltonian actions of loop groups” in Geometric Analysis. 9/01/99 – 8/31/02.

NSF Post-Doctoral Fellowship, '96-'99.

Sloan Doctoral Dissertation Fellowship, for the year '95-96 of graduate study at M.I.T.

Office of Naval Research Graduate Fellowship, for graduate study at M.I.T.

Herchel Smith Harvard Scholarship, for study at Emmanuel College, Cambridge, England in '91-92

Mathematical Publications (including those submitted)

- (1) Glen Wilson and Christopher T. Woodward, Quasimap Floer cohomology and singular symplectic quotients, arXiv:1105.0712. Submitted.
- (2) Christopher T. Woodward. Gauged Floer theory of toric moment fibers. *Geometric And Functional Analysis* 21 (2011) 680-749.
- (3) Christopher T. Woodward. Moment maps and geometric invariant theory. Expanded notes for lectures given at the school on Hamiltonian actions and their invariants at CIRM, Luminy, April 2009. 66 pages. CIRM Lecture Notes Vol. 1. arXiv:0912.1132.
- (4) Katrin Wehrheim and Chris Woodward. Quilted Floer Cohomology. *Geometry and Topology* 14 (2010) 833–902. Quilted floer trajectories with constant components: Corrigendum to *Quilted Floer cohomology*. Accepted to *Geometry and Topology*. arxiv:1101.3770.
- (5) Katrin Wehrheim and Chris T. Woodward. 35 pages. Pseudoholomorphic Quilts. arXiv:0905.1369. To appear in *Jour. Symp. Geom.*
- (6) K. Nguyen, C. Woodward, and F. Ziltener. Morphisms of cohomological field theory algebras and quantization of the Kirwan map. math.AG/0903.4459. 30 pages. Submitted.
- (7) E. Gonzalez and C. Woodward, Gauged Gromov-Witten theory for small spheres. arXiv:0907.3869. 34 pages. To appear in *Math. Zeit.*
- (8) E. Gonzalez and C. Woodward, Area-Dependence in Gauged Gromov-Witten theory. 43 pages. arXiv:0811.3358. Revised version according to referee’s report submitted.
- (9) E. Gonzalez and C. Woodward, Deformations of symplectic vortices. *Annals of Global Anal. and Geom.* 39 (2011) 45–82.
- (10) C. Manolescu and C. Woodward, Floer homology on the extended moduli space. 26 pages, arXiv:0811.0805. To appear in Viro conference proceedings.
- (11) S. Ma’u and C. Woodward. Geometric realizations of the multiplihedron and its complexification. *Compos. Math.* 146 (2010), no. 4, 1002-1028. arXiv:0802.2120.

- (12) Katrin Wehrheim and Chris T. Woodward. Floer Cohomology and Geometric Composition of Lagrangian Correspondences. 41 pages. arXiv:0905.1368. To appear in Adv. Math.
- (13) Katrin Wehrheim and Chris T. Woodward. Functoriality for Lagrangian correspondences in Floer theory. Quantum Topol. **1** (2010), no. 2, 129–170.
- (14) Constantin Teleman and Christopher T. Woodward. The Index Formula on the Moduli of G -bundles. Annals Math. **170** (2009) 495–527. The material in e-print math.AG/0512486 was combined into this paper.
- (15) C. Woodward. The Yang-Mills heat flow on the moduli space of framed bundles on a surface. Amer. J. Math. **28** (2006) 311–359.
- (16) Christopher T. Woodward. Localization for the norm-square of the moment map and the two-dimensional Yang-Mills integral. Jour. Symplectic Geom. **3** (2005) 17–54.
- (17) Y. Taylor and C. Woodward. Non-Euclidean tetrahedra and $6j$ symbols for $U_q(sl_2)$, Selecta Mathematica **11** (2005) 539–571.
- (18) C. T. Woodward. On D. Peterson’s comparison formula for Gromov-Witten invariants of G/P . Proc. Amer. Math. Soc. **133** (2005), 1601–1609.
- (19) A. Knutson, T. Tao, and C. Woodward. A positive proof of the Littlewood-Richardson rule using the octahedron recurrence. Electronic Journal of Combinatorics **11** (2004) R61.
- (20) W. Fulton and C. Woodward. On the quantum product of Schubert classes. J. Algebraic Geom. **13** (2004), 641–661.
- (21) Allen Knutson, Terence Tao, and Christopher Woodward. The honeycomb model of $GL_n(C)$ tensor products II: Facets of the Littlewood-Richardson cone. J. Amer. Math. Soc. **17** (2004) 19–48.
- (22) C. Teleman and C. Woodward. Parabolic bundles, products of conjugacy classes, and quantum cohomology. Ann. Inst. Fourier (Grenoble) **53** (2003) 713–748.
- (23) A. Alekseev, E. Meinrenken, and C. Woodward. Duistermaat-Heckman measures and moduli spaces of flat bundles over surfaces. Geom. funct. anal. **12** (2002) 1–31.
- (24) A. Alekseev, E. Meinrenken, and C. Woodward. Linearization of Poisson actions and singular values of matrix products. Ann. Inst. Fourier **51** (2001) 1691–1717.
- (25) A. Alekseev, E. Meinrenken and C. Woodward. The Verlinde formulas as fixed point formulas. Jour. of Symplectic Geom. **1**, 1–46 (2001), **2**, Publisher’s Correction 427–434 (2001).
- (26) C. Woodward. Gromov-Witten invariants of flag manifolds and products of conjugacy classes in *Advances in algebraic geometry motivated by physics (Lowell, MA, 2000)*, 279–286, Contemp. Math., 276, Amer. Math. Soc., Providence, RI, 2001.
- (27) E. Meinrenken and C. Woodward. Canonical bundles for Hamiltonian loop group actions. Pacific J. Math. **198** (2001) 477–487.
- (28) A. Alekseev, E. Meinrenken, and C. Woodward. Group-valued equivariant localization. Invent. Math. **140** (2000) 327–350.
- (29) A. Canas, V. Guillemin, and C. Woodward. On the unfolding of folded symplectic structures. Math. Res. Lett. **7** (2000), 35–53.
- (30) E. Meinrenken and C. Woodward. Cobordism for Hamiltonian loop group actions and flat connections on the punctured two-sphere. Math. Z. **231** (1999), 133–168.
- (31) S. Agnihotri and C. Woodward. Eigenvalues of products of unitary matrices and quantum Schubert calculus. Math. Res. Lett. **5** (1998), 817–836.
- (32) E. Meinrenken and C. Woodward. Moduli spaces of flat connections on 2-manifolds, cobordism, and Witten’s volume formulas, in *Advances in geometry*, 271–295, Progr. Math., 172, Birkhäuser, Boston, Boston, MA, 1998.
- (33) E. Meinrenken and C. Woodward. Hamiltonian loop group actions and Verlinde factorization. J. Differential Geom. **50** (1998), 417–469.

- (34) Eugene Lerman, Eckhard Meinrenken, Sue Tolman, and Chris Woodward. Non-abelian convexity by symplectic cuts, *Topology* **37** (1998) 245–259.
- (35) Chris T. Woodward. Spherical varieties and existence of invariant Kähler structures. *Duke Math. Jour.* **93** (1998), 345–377.
- (36) Chris Woodward. Multiplicity-free Hamiltonian actions need not be Kaehler. *Invent. Math.* **131** (1998), 311–319.
- (37) Chris Woodward. The classification of transversal multiplicity-free group actions. *Ann. Global Ann. Geom* **14** (1996), 3–42.

Other Publications

- (1) N. T. Maitra, T. Todorov, C. Woodward, K. Burke. On the density-potential mapping in time-dependent density functional theory. *Phys. Rev. A* Vol. 81 (a), no. 4, 042525.1–7 (2010).
- (2) Neepa T. Maitra, Kieron Burke, and Chris Woodward. Memory in time-dependent density functional theory. 4 pages. *Phys. Rev. Letts.* **89**, 023002 (2002).

Selected Conference, Seminar, and School Talks

“Wall-crossing for Gromov-Witten invariants under variation of git quotient”
Columbia conference on quantum differential equations, September ’11. Simons Institute conference on Mirror Symmetry, May ’11.

“Displaceability of toric moment fibers via gauged Floer theory” Kyoto Hayashibara Forum, Nov. ’10. MIT conference on Mirror Symmetry, June ’10.

“Moment maps and geometric invariant theory” Moment maps and geometric invariant theory. Lectures given at the school on Hamiltonian actions and their invariants at CIRM, Luminy, April 2009.

“Functoriality of Gromov-Witten theory under quotients”, Miami Workshop on Homological Mirror Symmetry, Jan ’08. Kyoto Conference on Algebraic Structures in TFT Feb ’09. Midwest Symplectic Geometry Conference March ’09.

“Gauged pseudoholomorphic maps”, CMS Conference in Toronto, Dec. ’06. Zurich conference on Mathematical Physics and Symplectic Geometry, Sep. ’07. AMS Special Session on Symplectic geometry and algebraic combinatorics, Oct. ’07. KIAS (Seoul) conference on Gromov-Witten theory. June ’08. Winter School in Mathematical Physics, Les Diablerets, Switzerland, Jan. ’10.

“Functoriality for Lagrangian correspondences in Floer theory”, Aarhus Conference on Geometry and Quantization of Moduli Spaces, July ’06, Courant Differential Geometry Seminar, April ’06; Princeton Moduli and Geometry seminar March ’06. Banff Conference on Floer theory, May ’07. Workshop on Mirror Symmetry and Symplectic Geometry, May ’08. Workshop on Mirror Symmetry and Symplectic Geometry, May ’08. Oberwolfach workshop on categorical aspects of physics, June ’10.

“Localization for the norm-square of the moment map”, Toronto Symplectic Geometry seminar, October ’04. (Montreal) Conference on the large N limit in two-dimensional Yang-Mills theory, January ’04.

“Non-Euclidean tetrahedra and $6j$ symbols for $U_q(sl_2)$ ” Porto conference on quantum gravity, July ’04. Edinburgh conference on 2+1 dimensional gravity, July ’03. Poisson Conference in Lisbon, September ’02;

“A Kirwan-Ness stratification for loop group actions” Symplectic Geometry Conference at M.I.T., April ’02;

“Quantum products of Schubert classes”, CRM (Montreal) Conference on Algebraic Groups, June '02; Fields Institute (Toronto) Conference on Symplectic Geometry and Quantization, June '01.

“Honeycombs and facets of the Littlewood-Richardson cone”, AMS Special Session on Modern Schubert Calculus, Toronto, October '00.

“Poisson moment maps and the hyperbolic Duflo theorem”, AMS Special Session on Deformation Quantization, Hoboken, April '01; Conference on Representation Theory, ESI, Vienna, July '00.

“Parabolic G-bundles and products of conjugacy classes”, Univ. of Maryland Geometry Seminar, February '01; AMS Special Session on Enumerative Geometry and Physics, April '00; Johns Hopkins Analysis Seminar, October '99.

“The Verlinde formula as a fixed point formula”, Montreal Conference on Symplectic Geometry and Geometric Quantization, September '99; Ascona Conference on Geometric Quantization and Quantum Integrable Systems, June '99; AMS Special Session on Symplectic Geometry, Pennsylvania State University, October '98;

“Eigenvalue inequalities, moduli spaces of flat connections, and quantum Schubert calculus”, Bryn Mawr Colloquium, September '99; Cornell Topology Festival, May '99; Northwestern Colloquium, April '98; AMS Workshop on Quantum Cohomology, June '98; AMS Special Session, Montreal, September '97.

On Hamiltonian loop group actions and moduli spaces of flat connections, Institute Fourier, Grenoble, June '97; AMS Special Session, College Park, April '97;

On the Kählerizability of Hamiltonian actions, Kazimierz Conference on Algebraic Group Actions, June '96; E.N.S. (France) Geometric Quantization Seminar, June '95; Lyon (France) Lie Seminar, June '95.

On the classification of multiplicity-free actions. Isaac Newton Institute (Cambridge, England) Workshop in Hamiltonian Group Actions, November '94; M.I.T. Symplectic Seminar, April '94 and October '94.

Revised 11/11/11