Mark A. Colarusso

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Birth Date: June 27, 1981.

Place of Birth: Hamilton, Ontario, Canada.

Citizenship: United States and Canada.

Current Position

Visiting Assistant Professor, University of Wisconsin, Milwaukee.

Education

Ph.D. Mathematics, University of California, San Diego, June 2007.

M.A. Mathematics, University of California, San Diego, December 2005.

B.Sc. Mathematics with Distinction, Queen's University (Kingston, Ontario, Canada), May 2003.

Grant Support

NSA, Mathematical Sciences Program, Young Investigator Award (December 2015-December 2017, $\$40,000$) (Only 15 % of grant applications in algebra funded in FY 2015.)

Awards and Honors

Natural Sciences and Engineering Research Council of Canada Post Graduate Scholarship Doctoral. University of California, San Diego, 09/2005-06/2007.

Natural Sciences and Engineering Research Council of Canada Post Graduate Scholarship Master. University of California, San Diego, 09/2003-09/2005.

NSF Graduate Research Fellowship, Honorable Mention. University of California, San Diego, 05/2003.

Prince of Wales Prize, Honorable Mention (for second highest standing in bachelor of science program). Queen's University, 05/2003.

Medal in Mathematics and Statistics. Queen's University, 05/2003.

Stirling Scholarship. Queen's University, 09/1999-05/2003.

Appointments

1. 08/2012-present: Visiting Assistant Professor, University of Wisconsin, Milwaukee.
2. 09/2011-05/2012: Visiting Assistant Professor, Idaho State University.
3. 09/2010-09/2011: Postdoctoral Fellow, Université Laval.
4. 08/2007-08/2010: Visiting Assistant Professor, University of Notre Dame.
5. 01/2007-04/2007: Associate Instructor, University of California, San Diego.
6. 09/2003-12/2006: Teaching Assistant, University of California, San Diego.
7. 07/2004-09/2004, 07/2005-09/2005, 07/2006-09/2006: Research Assistant, University of California, San Diego.
8. 01/2003-04/2003: Teaching Assistant, Queen's University.

Research Interests

Lie theory

Algebraic Group Theory

Invariant Theory

Representation Theory

Poisson Geometry

Symplectic Geometry

Integrable Systems

Publications

1. Colarusso, Mark. The Gelfand-Zeitlin Integrable System and Its Action on Generic Elements of $gl(n)$ and $so(n)$. In *New Developments in Lie Theory and Geometry (Cruz Chica, Córdoba, Argentina, 2007)*, volume 491 of *Contemp. Math.*, pages 255-281. Amer. Math. Soc., Providence, RI, 2009.
2. Colarusso, Mark and Evens, Sam. On Algebraic Integrability of Gelfand-Zeitlin Fields, Transform. Groups **15** (2010), no.1, 46-71.
3. Colarusso, Mark. The Orbit Structure of the Gelfand-Zeitlin Group on $n \times n$ Matrices, Pacific J. Math. **250** (2011), no. 1, 109-138.
4. Colarusso, Mark and Evens, Sam. K-orbits on the Flag Variety and Strongly Regular Nilpotent Matrices, Selecta. Math. (N.S.), **18** (2012), no.1, 159-177.
5. Colarusso, Mark and Evens, Sam. The Gelfand-Zeitlin Integrable System and K-orbits on the Flag Variety in "Symmetry: representation theory and its applications", 85-119, Progr. Math., **257**, Birkauser/Springer, New York, 2014.
6. Colarusso, Mark and Evens, Sam. Eigenvalue Coincidences and K-orbits, I. J. Algebra **422** (2015), 611-632.
7. Colarusso, Mark and Lau, Michael. Lie-Poisson Theory for Direct Limit Lie Algebras, J. Pure. Appl. Algebra **220** (2016), no. 4, 1489-1516.

Preprints

1. Colarusso, Mark and Evens, Sam. Eigenvalue Coincidences and Multiplicity Free Spherical pairs, arxiv.org: 1410.3901 v2, 38 pages.

Papers near completion

1. Geometry of K-orbits on the flag variety for multiplicity free spherical pairs (G, K) (joint with Sam Evens) approx 30 pages.
2. On complex Gelfand-Zeitlin integrable systems (joint with Sam Evens) approx 60 pages.

Work in Progress

1. A Geometric Construction of generalized Harish-Chandra modules for the partial Gelfand-Zeitlin algebra (joint with Sam Evens).
2. A nonlinear Gelfand-Zeitlin system and a complex Ginzburg-Weinstein diffeomorphism (joint with Sam Evens).
3. An analogue of the Joseph-Letzter theorem for the Gelfand-Zeitlin algebra of $U_q(gl(n, C))$. (joint with Sam Evens).

Dissertation

The Gelfand-Zeitlin Algebra and Polarizations of Regular Adjoint Orbits for Classical Groups, University of California, San Diego, 2007.
Supervisor: Nolan Wallach.

Teaching

Lecture Series

October 2012-December 2012: Mini-course for grad students and professors on Poisson-Lie theory at UW-Milwaukee. The course consisted of five one hour lectures.

September 2010-November 2010: Mini-course on Lie theory and integrable systems for professors and graduate students at Université Laval. The course consisted of ten one hour lectures.

Courses Taught

University of Wisconsin–Milwaukee

Spring 2017: Modern Algebra Part II (advanced course for masters students and advanced undergraduates), integral calculus, algebra seminar (organizing topic and speakers for algebra seminar).

Fall 2016: Modern Algebra, Part I , Modern Algebra with applications (approx 30 students).

Spring 2016: Modern algebra, Part II, Calculus and analytic geometry.

Fall 2015: Modern algebra, Part I, Calculus and analytic geometry.

Spring 2015: Calculus and analytic geometry.

Fall 2014: Calculus and analytic geometry.

Spring 2014: Advanced differential geometry and Lie theory (topics course for advanced Ph.D. students: De Rahm cohomology, Lie theoretic methods in mathematical physics, approx 10 students).

Fall 2013: Introduction to differential geometry and Lie theory (topics course for advanced Ph.D students, approx 15 students).

Summer 2013: Summer algebra seminar for masters students. Lectured and led problem sessions for masters students on special topics in algebra not already covered in the curriculum to prepare students for topics classes and Ph.D level classes in algebra.

Spring 2013: Modern algebra, Part II.

Fall 2012: Modern algebra, Part I.

Idaho State University

Winter 2012: Linear Algebra.

Winter 2012: Brief Calculus, (two sections).

Fall 2011: Brief Calculus, (two sections).

Fall 2011: College Algebra.

University of Notre Dame

I actively participated in the SUMR (seminar for undergraduate research) program at Notre Dame. This is a program geared for advanced undergraduates who desire to pursue graduate studies in mathematics. My duties included teaching courses in the program, giving an advanced reading class, and mentoring these students.
Spring 2010: Honours Linear Algebra II.

Fall 2009: Honours Linear Algebra I.

Spring 2009: Honours Calculus II.

Fall 2008: Honours Calculus I.

Spring 2008: Honours Reading Seminar on Representation Theory of Finite Groups.

Spring 2008: Calculus I.

Fall 2007: Calculus II (approx 70 students).

University of California, San Diego

Spring 2007: Precalculus (approx. 100 students).

Mentoring/Teaching Activities

Independent Study, Directed an independent study for an advanced high school student, University of Wisconsin, Milwaukee, Spring 2016.

Capstone Project, "Introduction to Lie theory for advanced undergraduates", University of Wisconsin, Milwaukee, Spring 2016.

Graduate Advising Committee, University of Wisconsin, Milwaukee, August 2015 and August 2016.

Assisted in writing and grading masters qualifying exam in algebra, May 2013/2016 and August 2016. I also ran special problem sessions to prepare the masters students for the exam.

Nominated for Excellence in Teaching Award, by the LDS institute of religion at Idaho State University, Fall 2011.

Mentored Graduate Student 06/2009-08/2010. Lectured second year graduate student on basics of Lie theory, differential geometry, and algebraic geometry once a week.

Math Club Lecture, February 2009 and November 2015, Title: Impossible Constructions: Why You Cannot Square the Circle and Double the Cube.

Orgranizer, SUMR Lunch Seminar, Fall 2007. Ran a lunch-time seminar with another postdoc for the students in the SUMR program. We discussed applying to grad school, pursuing graduate work in mathematics, and application to REUs (research experience for undergraduate programs).

Lecturer, SUMR Topology Reading Group, Fall 2007. Gave several lectures to advanced students about basic point set topology.

Invited Research Visits

1. University of Sao Paolo, Brazil, November 23-30, 2013. Host: Vyascheslav Futorny.
2. Université Laval, December 18-25, 2011. Host: Michael Lau.
3. University of Notre Dame, March 23-29, 2011. Host: Sam Evens.
4. University of Sao Paolo, Brazil, October 18-25, 2008. Host: Vyascheslav Futorny.

Invited Lectures

1. Joint Mathematical meetings, Special Session on Lie Group Representations, Discretization, and Gelfand Pairs, Atlanta, GA, Jan 4-7, 2017.
2. AMS 2016 Fall Central Sectional Meeting, Special Session on Integrable Systems and Related Areas, Minneapolis, MN, Oct 28-29, 2016.
3. AMS 2014 Fall Central Sectional Meeting, Special Session on Lie Algebras and Representation theory, Eau Claire, WI, Sept 20-21, 2014.
4. Lie theory seminar, University of California, San Diego, July 2, 2014.
5. Centre de Recherches Mathématiques (CRM), Workshop on Lie theory and Mathematical Physics, May 19-23, 2014.
6. University of Notre Dame, Felix Klein Seminar, April 3, 2014.
7. Baylor University, Department Colloquium, March 27, 2014.
8. Université Laval, Department Colloquium, December 5, 2013.
9. University of Sao Paolo, Brazil, Research Workshop, November 29, 2013.
10. University of Sao Paolo, Brazil, Algebra Seminar, November 28, 2013.
11. AMS 2013 Fall Western Sectional Meeting, Special Session on Geometric and Combinatorial Aspects of Representation Theory, Riverside, CA, November 2, 2013.
12. Algebra Seminar, Université Laval, December 20, 2011.
13. AMS 2011 Fall Western Sectional Meeting, Special Session on Reductive Groups and Hecke Algebras, Salt Lake City, UT, October 22, 2011.
14. Lie Theory and Its Applications, Conference in Honor of Nolan Wallach, University of California, San Diego, March 19, 2011.
15. Algebraic Geometry Seminar, Queen's University, Kingston, ON, February, 14, 2011.
16. AMS 2011 Joint Meetings, Special Session on Completely Integrable Systems, Random Matrices, and the Bispectral Problem, New Orleans, LA, January 8, 2011.
17. AMS 2011 Joint Meetings, Special Session on Analytic and Geometric Methods in Representation Theory, New Orleans, LA, January 6, 2011.
18. University of Toledo, Departmental Colloquium, December 15, 2010.
19. AMS 2010 Fall Central Section Meeting, Special Session on Geometry and Lie theory, Notre Dame, IN, November 6, 2010.
20. Conference on Surfaces and Representations, University of Sherbrooke, October 7, 2010.
21. Québec-Maine Number Theory Conference, Université Laval, October 2, 2010.
22. University of Windsor, Department Colloquium, August 12, 2010.
23. International Workshop on Infinite Dimensional Lie Algebras, Atlantic Algebra Centre, Bonne Bay, NL, July 19, 2010.
24. Baylor University, Departmental Colloquium, February 17, 2010.
25. Louisiana State University, Departmental Colloquium, January 26, 2010.
26. University of Windsor, Lie Theory Seminar, November 6, 2009.

27. University of Windsor, Departmental Colloquium, November, 5, 2009.
28. AMS 2009 Fall Eastern Section Meeting, Special Session on Integrable Systems and Related Areas, University Park, PA, October 24, 2009.
29. AMS 2009 Fall Central Section Meeting, Special Session on Lie Groups, Lie Algebras and Representation Theory, Waco, TX, October 17, 2009.
30. University of Sao Paolo, Brazil, Algebra Seminar, October 22, 2008.
31. University of Wisconsin, Milwaukee, Departmental Colloquium, October 5, 2007.
32. Baylor University, Departmental Colloquium, June 8, 2007.
33. University of California, Riverside, Lie Theory Seminar, January 25, 2007.

Committee Work

Algebra masters exam committee, University of Wisconsin-Milwaukeee, 2016-2017.

Calculus curriculum reform committee, University of Wisconsin-Milwaukee, 2015-2016.

Ph.D. Candidacy Examination Committee for Martha Precup, University of Notre Dame, January 2010.

Ph.D. Dissertation Committee for Tom Edgar, University of Notre Dame, July 2009, Title of Dissertation: Dominance and Regularity in Coxeter Groups.

Additional Information

REU (research experience for undergraduates) experiences

1. 06/2002-08/2002: NSF funded REU (research experience for undergraduates) in mathematics at Indiana University. (Worked in non-commutative ring theory).
2. 06/2001-08/2001: NSF funded REU in physics at Triangle Universities Nuclear Laboratory at Duke University. (Worked in applied mathematics).

Foreign Languages

1. French reading and speaking knowledge.
2. German reading knowledge.

Computer Skills

1. Experience with Mathematica.
2. Experience with Java.

References

Nolan Wallach, Professor at the University of California, San Diego, Department of Mathematics.
Email: nwallach@ucsd.edu

Sam Evens, Professor at the University of Notre Dame, Department of Mathematics.
Email: sevens@nd.edu

Vyacheslav Futorny, Professor at the University of Sao Paulo, Institute of Mathmatics.
Email: futorny@ime.usp.br

Gilbert Strang, Professor at Massachusetts Institute of Technology, Department of Mathematics.
Email:gilstrang@gmail.com

Jeb Willenbring, Professor at the University of Wisconsin, Milwaukee, Department of Mathematical Sciences.
Email: jw@csd.uwm.edu (Letter concerns both research and teaching.)

Robert Fisher, Professor and Department Head at Idaho State University, Department of Mathematics.
Email: fishrobe@isu.edu. (Letter concerns teaching.)

Michael Gekhtman, Professor at the University of Notre Dame, Department of Mathematics.
Email: gekhtman.1@nd.edu (Letter concerns both research and teaching.)

Michael Lau, Associate Professor, Universite Laval, Department of Mathematics and Statistics,
Email: Michael.Lau@mat.ulaval.ca