

Curriculum Vitae

GARETH E. ROBERTS

Associate Professor of Mathematics
College of the Holy Cross

**Items in boldface indicate activities occurring between
October 1, 2008 and September 30, 2009**

Phone: 508-793-2350 *email:* groberts@radius.holycross.edu
Homepage: <http://mathcs.holycross.edu/~groberts/homepage.html>

Education

BOSTON UNIVERSITY, Boston, MA. Ph.D. in Mathematics, May, 1999.

Advisor: Glen Hall

Dissertation: *Existence and Stability of Relative Equilibria in the N-Body Problem.*

OBERLIN COLLEGE, Oberlin, Ohio. B.A. in Mathematics, *High Honors*, May, 1992.

Academic Appointments

College of the Holy Cross, *Associate Professor*, 2001–Present.

University of Minnesota, Minneapolis, *Visiting Professor*, Spring 2004.

Boston University, *Visiting Professor*, Fall 2003.

University of Colorado, Boulder, *NSF VIGRE Postdoctoral Research Associate*, 1999–2001.

The Hun School of Princeton, *Secondary School Teacher*, 1992–1994.

Courses Taught

At Holy Cross:

MATH 110: Topics in Mathematics: Mathematics and Music

MATH 125: Calculus for the Social Sciences I

MATH 126: Calculus for the Social Sciences II

MATH 131: Calculus for the Physical and Life Sciences I

MATH 132: Calculus for the Physical and Life Sciences II

MATH 136: Advanced Placement Calculus

MATH 241: Multivariable Calculus

MATH 242: Principles of Analysis

MATH 303: Mathematical Models

MATH 304: Ordinary Differential Equations

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MATH 373: Principles and Techniques of Applied Mathematics
MATH 374: Dynamical Systems
MATH 392: Seminar in Celestial Mechanics

At the University of Colorado, Boulder:

APPM 2350: Calculus III for Engineers
APPM 3310: Matrix Methods and Applications

At Boston University:

Linear Algebra (*Instructor*)
Calculus I, Differential Equations (*Teaching Assistant*)

At the Hun School of Princeton:

Algebra I and II, Geometry, Precalculus

Tutorials, Internships, Honors Theses

At Holy Cross:

MATH 496: Mathematics Honors Thesis, Shea Sennett (HC '10)
Collinear Central Configurations in the N -Body Problem (2009–2010).

MATH 400: Directed Project, Julianne Kulevich and Christopher J. Smith (both HC '08),
Celestial Mechanics (Fall 2007).

MATH 400: Directed Project, Lisa Melanson (HC '06)
Celestial Mechanics (Fall 2005).

MATH 496: Mathematics Honors Thesis, Trevor O'Brien (HC '05)
Elusive Zeros Under Newton's Method (2004–2005).

READER: Computer Science Honors Thesis, Erin Connors (HC '06)
The Detection of Moving Objects by Moving Observers (Spring 2006).

At the University of Colorado, Boulder:

APPM 4840: Independent Study, Jeremy Horgan-Kobelski (UC Boulder '02)
Complex Dynamics and Numerical Methods (2000–2001).

College, Department and Professional Service

Service to the Department:

Faculty Co-Advisor, Math/CS Club (2007–2008, with Steven Levandosky).

Co-Organizer, Putnam Mathematics Exam (2002–2003 and 2004–2008, with John Little).

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Organizer, Math/CS Departmental Banquet (2007–2008).
Primary Faculty Advisor, Math/CS Club (2002–2003 and 2004–2007).
Organizer, Departmental Colloquia (2002–2003 and 2004–2007).
Organizer, Upper-Level Course Fairs (2002–2003 and 2004–2007).
Organizer, Pi Mu Epsilon Induction Ceremony (Spring 2003 and 2007).
Co-Organizer, Math/CS Dept. Banquet (2002–2003 and 2004–2007).
Member, Calculus Textbook Committee (2005–2006).
Organizer, Departmental Research Seminar (2002–2003).
Member, Departmental Library Committee (Spring 2003).
Member, Departmental Honors Committee (2001–2002).
Co-Founder, “Tea & Games” (Spring 2002, with Sharon Frechette and Catherine Roberts).
Dept. Rep, United Way/Holy Cross Giving Campaign (2001–2002 and 2006–2007).

Service to the College:

Faculty Mentor, The Mentor Program (2005–2008).
Member, Community Standards Board (2004–2008).
Member, Division of Student Affairs Self-Assessment Committee, “Student Learning and Developmental Outcomes” (Spring 2008).
Co-Organizer, *Hogwarts at Holy Cross VIII: Lumos Roboticus* (March 18, 2006).
Member, Student Life Council (2004–2006).
Member, Consensual Sexual Relations Hearing Committee and the Harassment Grievance Committee (2005–2006).
Faculty Marshal, 2004 Baccalaureate Mass and Commencement Exercises.
Member, Engagement with Values Curriculum Group (2002–2003).
Panelist, New Faculty Orientation Program (Nov. 19, 2002).
Invited Lecturer, *Life on the Hill: A Holy Cross Sampler* (Oct. 26, 2002).
Faculty Advisor, Holy Cross Ultimate Frisbee Team (2002–Present).

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Service to the Profession:

Referee: (number of referee reports written at Holy Cross indicated in parentheses)

***Advances in Mathematics* (1)**

American Mathematical Monthly

Celestial Mechanics: Dedicated to Donald Saari for his 60th Birthday, *Contemporary Mathematics* Vol. 292 (Conference Proceedings)

Celestial Mechanics and Dynamical Astronomy (1)

Dynamics of Continuous, Discrete and Impulsive Systems (1)

Journal of Computational and Applied Mathematics (1)

Journal of Differential Equations (2)

Journal of Mathematical Analysis and Applications (2)

Nonlinearity (1)

***Physica D: Nonlinear Phenomena* (1)**

Proceedings of the American Mathematical Society

***Qualitative Theory of Dynamical Systems* (Conference Proceedings of HamSys 2008) (1)**

SIAM Journal on Applied Dynamical Systems (4)

SIAM Journal on Mathematical Analysis

Reviewer:

Mathematical Reviews (17 published reviews, 15 written at Holy Cross).

Differential Equations, Dynamical Systems and An Introduction to Chaos, Second Edition, Hirsch, Smale and Devaney, Elsevier Academic Press, 2004.

Session Co-Organizer:

***Special Session on the Mathematics of Climate Change*, 2009 AMS Spring Eastern Section Meeting, Worcester, (April 25–26, 2009). Co-organized with Catherine Roberts (HC) and Mary Lou Zeeman (Bowdoin College).**

Special Session on Celestial Mechanics, Joint AMS/MAA

Mathematics Meetings, Phoenix, Arizona (January 7–10, 2004). Co-organized with Samuel R. Kaplan (Univ. North Carolina at Asheville).

Session Chair: *Hamiltonian Dynamics - Part II of II*, 2005 SIAM Conference on Applications of Dynamical Systems, Snowbird, Utah (May 22–26, 2005).

Invited Lecturer: *Mathematics Field Day*, Boston University (October 17, 2006)
Principal lecture “Math and Music: Exploring the Connections,” given to over five-hundred high school students and teachers.

Textbook Project Manager: Boston University (1995–1997)

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Differential Equations, Blanchard, Devaney and Hall, Brooks/Cole, 1998.

Professional Organizations:

Member, American Mathematical Society (AMS), Council on Undergraduate Research (CUR), Mathematical Association of America (MAA), Phi Beta Kappa, Society for Industrial and Applied Mathematics (SIAM).

Grants, Awards, Honors

National Science Foundation Award DMS-0708741, Applied Mathematics Program, Division of Mathematical Sciences, July 1, 2007 - June 30, 2010 (\$124,036).

Charles & Rosanna Batchelor (Ford) Faculty Fellowship, College of the Holy Cross, Summer 2007 (\$3,500).

Council on Undergraduate Research (CUR) Student Summer Research Fellowship in Mathematics and Science, 2004 (\$3,000).

Charles & Rosanna Batchelor (Ford) Faculty Fellowship, College of the Holy Cross, Summer 2002 (\$3,200).

Outstanding Teaching Fellow Award, Boston University, 1998.

Presidential University Graduate Fellowship, Boston University, 1994.

Rebecca Cary Orr Memorial Prize in Mathematics, Oberlin College, 1992.

Phi Beta Kappa, Oberlin College, 1992.

Refereed Publications

At Holy Cross:

1. **Finiteness in the Restricted Four-Body Problem (with J. Kulevich and C. Smith, both HC '08), to appear in the Conference Proceedings of the Fifth International Symposium in Hamiltonian Systems and Celestial Mechanics (HAMSYS 2008), to be published as a special issue of *Qualitative Theory of Dynamical Systems*.**
2. Linear Stability Analysis of the Figure-Eight Orbit in the Three-Body Problem, *Ergodic Theory and Dynamical Systems* **27**, 1947–1963, 2007.
3. Saari's Conjecture for the Restricted Three-Body Problem (with L. Melanson, HC '06), *Celestial Mechanics and Dynamical Astronomy* **97**, no. 3, 211–223, 2007.
4. Some Counterexamples to a Generalized Saari's Conjecture, *Transactions of the American Mathematical Society* **358**, no. 1, 251–265, 2006.

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5. Newton's Versus Halley's Method: A Dynamical Systems Approach (with J. Horgan-Kobelski), *International Journal of Bifurcation and Chaos* **14**, no. 10, 3459–3475, 2004.
6. Linear Stability of the Elliptic Lagrangian Triangle Solutions in the Three-Body Problem, *Journal of Differential Equations* **182**, 191–218, 2002.
7. **Conducting Mathematical Research with Undergraduates**, submitted to the **Conference Proceedings for the Conference on Innovation in Undergraduate Teaching and Research** (Montclair State University, June 4-5, 2008), to be published as a special issue of *Primus*.
8. **Linear Stability for Some Symmetric Periodic Simultaneous Binary Collision Orbits in the Four-Body Problem** (with L. Bakker, T. Ouyang, S. Simmons and D. Yan), submitted to *Celestial Mechanics and Dynamical Astronomy*.
9. **Cyclic Central Configurations in the Four-Body Problem** (with J. Cors and G. Hall), in preparation.
10. **Elusive Zeros Under Newton's Method** (with T. O'Brien, HC '05), in preparation.

Prior to Holy Cross:

11. Drift by Coupling to an Anti-Integrable Limit (with R. Easton and J. Meiss), *Physica D* **156**, 201–218, 2001.
12. Dynamical Convergence of Polynomials to the Exponential (with C. Bodelón, R. Devaney, L. Goldberg, M. Hayes and J. Hubbard), *Journal of Difference Equations and Applications* **6**, 275–307, 2000.
13. Linear Stability in the $1 + n$ -gon Relative Equilibrium, *Hamiltonian Systems and Celestial Mechanics (HAMSYS-98)*, World Scientific Monograph Series in Mathematics **6**, 303–330, 2000.
14. Existence and Stability of Relative Equilibria in the N -Body Problem, *International Conference on Differential Equations, Vol. 1,2 (Berlin, 1999)* World Sci. Publishing, River Edge, NJ, 30–35, 2000 (conference proceedings).
15. Spectral Instability of Relative Equilibria in the Planar N -Body Problem, *Nonlinearity* **12**, 757–769, 1999.
16. A Continuum of Relative Equilibria in the Five-Body Problem, *Physica D* **127**, nos. 3-4, 141–145, 1999.
17. Hairs for the Complex Exponential Family (with C. Bodelón, R. Devaney, L. Goldberg, M. Hayes and J. Hubbard), *International Journal of Bifurcation and Chaos* **9**, no. 8, 1517–1534, 1999.

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Invited Lectures and Presentations

Outside the United States:

Using BKK Theory in Restricted N-Body Problems

2008 Canadian Mathematical Society Winter Meeting
Ottawa, Canada, December 6–8, 2008.

The Fifth International Symposium (HAMSYS-2008) on Hamiltonian Systems and Celestial Mechanics, CIMAT, Guanajuato, Mexico, July 7–11, 2008.

Linear Stability Analysis of the Figure-Eight Orbit

Laurier Dynamics Seminar, Wilfrid Laurier University
Waterloo, Ontario, Canada, December 3, 2008.

On Linear Stability in the N-Body Problem

Dynamical Systems Seminar, Institute of Mathematics, Academia Sinica,
Taipei, Taiwan, May 22, 2007.

On Linear Stability in the N-Body Problem I, II, and III

NCTS Workshop on Dynamical Systems, National Center for Theoretic Sciences,
Hsinchu, Taiwan, May 14–18, 2007.

One of five invited speakers to present a mini-course consisting of 3 one-hour lectures.

Linear Stability Analysis of the Figure-Eight Orbit

Celestial Mechanics Workshop, Banff International Research Station, Banff, Canada,
April 17–22, 2004.

Some Counterexamples to a Generalized Saari's Conjecture

Equadiff 2003, Hasselt, Belgium, July 22–26, 2003.

When Numerical Methods Fail: A Dynamical Systems Approach

New Directions in Dynamical Systems, Kyoto University, Kyoto, Japan, August 5–15, 2002.

Linear Stability of the Elliptic Lagrangian Triangle Solutions in the Three-Body Problem

The Fourth International Symposium on Hamiltonian Systems and Celestial Mechanics,
Guanajuato, Mexico, March 19–24, 2001.

Existence and Stability of Relative Equilibria in the N-Body Problem

Equadiff 99, Berlin, Germany, Aug. 1–7, 1999.

Special Seminar in Celestial Mechanics, Astronomie et Systèmes Dynamiques,
Bureau des Longitudes, Paris, France, July 29, 1999.

Stability of Relative Equilibria in the N-Body Problem

The Third International Symposium on Hamiltonian Systems and Celestial Mechanics,

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Patzcuaro, Michoacan, Mexico, Dec. 6–12, 1998.

Inside the United States:

On Central Configurations

Faculty Research Seminar, Department of Mathematics and Computer Science
College of the Holy Cross, February 5 and 12, 2009.

I've Got a Three-Body Problem

Mathematics Colloquium, Fitchburg State College, November 13, 2008.

Using BKK Theory in Restricted N-Body Problems

Dynamical Systems Seminar, Department of Mathematics
Brigham Young University, October 21, 2008.

Algebraic Geometry Research Group, Department of Mathematics
Brigham Young University, October 23, 2008.

Using Algebraic Geometry in Celestial Mechanics

Conference on Innovation in Undergraduate Teaching and Research
Montclair State University, June 4–5, 2008.

Math and Music: Exploring the Connections

Invited Speaker, Pi Mu Epsilon Mass. Gamma Chapter Induction Ceremony,
Bridgewater State College, Bridgewater, MA, April 27, 2008.

Classroom Revisited 2008: Continuing Education Day,
College of the Holy Cross, April 5, 2008.

The Planar, Circular, Restricted Four-Body Problem

Faculty Research Seminar, Department of Mathematics and Computer Science
College of the Holy Cross, April 17, 2008

AMS Session on Applications of Mathematics III, AMS/MAA Joint
Mathematics Meetings, San Diego, January 6–9, 2008.

Saari's Conjecture for the Restricted Three-Body Problem

2007 SIAM Conference on Applications of Dynamical Systems,
Snowbird, Utah, May 28 – June 1, 2007.

An Amazing Bifurcation Diagram Arising from Newton's Method

MAA Session "Chaos and Fractals," AMS/MAA Joint Mathematics Meetings,
New Orleans, January 5–8, 2007.

Saari's Conjecture for the Restricted Three-Body Problem

AMS Session on Applications of Mathematics I, AMS/MAA Joint

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Mathematics Meetings, New Orleans, January 5–8, 2007.

When Numerical Methods Fail but Undergraduates Succeed

Invited lecture, Spring Meeting of the Northeastern Section of the Mathematical Association of America, Boston University, June 2–3, 2006.

Using BKK Theory in Celestial Mechanics

Faculty Research Seminar, College of the Holy Cross, April 20, 2006.

Symmetry and Stability in Hamiltonian Systems

2005 SIAM Conference on Applications of Dynamical Systems, Snowbird, Utah, May 22–26, 2005.

Dancing with the Stars: Circles, Figure-Eights and Braids in the N-Body Problem

WPI 2005 Math Awareness Month Lecture, WPI, April 28, 2005.

Interesting Symmetric Orbits in the Three-Body Problem,

WPI Partial Differential Equations Seminar, WPI, February 2, 2005.

The Amazing Figure-Eight Orbit of the Three-Body Problem and its Linear Stability

Faculty Research Seminar, College of the Holy Cross, October 14 and 21, 2004.

The Amazing Figure-Eight Orbit of the Three-Body Problem

Dynamical Systems Seminar, Boston University, November 22, 2004.

Fall 2004 Meeting of the Northeastern Section of the Mathematical Association of America, WPI, November 19–20, 2004.

Holy Cross Summer Research Seminar, College of the Holy Cross, June 30, 2004.

Graduate Colloquium, University of Minnesota, Duluth, May 5, 2004.

Linear Stability Analysis of the Figure-Eight Orbit

Dynamical Systems Seminar, University of Minnesota, Minneapolis, April 12, 2004.

Some Counterexamples to a Generalized Saari's Conjecture

Special Session on Celestial Mechanics, AMS/MAA Joint Mathematics Meetings, Phoenix, Arizona, January 7–10, 2004.

“Solving” Complicated Differential Equations: An Introduction to the N-Body Problem

Undergraduate Colloquium, Oberlin College, Nov. 3, 2003.

Saari's Conjecture for a Certain Class of N-Body Problems

Faculty Research Seminar, College of the Holy Cross, Oct. 7 and 14, 2003.

Dynamical Systems Seminar, Boston University, Sept. 29, 2003.

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Saari's Conjecture: The Case For and Against

Workshop on Variational Methods in Celestial Mechanics, The American Institute of Mathematics, Pal Alto, California, June 9–14, 2003.

Relative Equilibria and Saari's Conjecture

2003 SIAM Conference on Applications of Dynamical Systems, Snowbird, Utah, May 26–31, 2003.

Central Configurations and Their Importance in the N -Body Problem

Undergraduate Colloquium, Montclair State University, March 3, 2003.

Faculty Research Seminar, College of the Holy Cross, Nov. 6 and 13, 2002.

When Numerical Methods Fail: A Dynamical Systems Approach

Pi Mu Epsilon Colloquium, College of the Holy Cross, April 18, 2002.

Newton's versus Halley's method: An Approach via Complex Dynamics

Dynamics Days 2002, Baltimore Maryland, Jan. 4–7, 2002 (poster presentation).

Faculty Research Seminar, College of the Holy Cross, Sept. 27, 2001.

Seminar in Dynamical Systems, University of Colorado at Boulder, Nov. 16, 2000.

Linear Stability of the Elliptic Lagrangian Triangle Solutions in the Three-Body Problem

2001 SIAM Conference on Applications of Dynamical Systems, Snowbird, Utah, May 20–24, 2001.

Southwest Dynamics Workshop, University of Southern California, November 16–19, 2000.

Dynamical Systems Seminar, Boston University, October 2, 2000.

The Theory of the Moon Gives Me Headaches: An Introduction to the N -Body Problem

Job Talk, College of the Holy Cross, Feb. 12, 2001.

Stability of Elliptic Periodic Orbits in the N -Body Problem

International Conference on Dynamical Systems and Differential Equations, Kennesaw State University, May 18–21, 2000.

Colloquium in Applied Mathematics, University of Colorado at Boulder, April 7, 2000.

Seminar in Dynamical Systems, University of Colorado at Boulder, April 6, 2000.

Midwest Dynamical Systems Conference, University of Florida at Gainesville, March 9–12, 2000.

Seminar in Dynamical Systems, University of Colorado at Boulder, Dec. 9, 1999.

Interesting Families of Central Configurations

International Conference on Celestial Mechanics, Northwestern University, Dec. 15–19, 1999.

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Tufts-UMass/Lowell-Northeastern Dynamics Seminar, Northeastern University, Feb. 4, 1999.

Hairs for the Complex Exponential and Polynomial Families

Seminar in Applied Mathematics, University of Colorado at Boulder, July 20, 1999.

Existence and Stability of Relative Equilibria in the N-Body Problem

Dynamical Systems Seminar, Boston University, April 5, 1999.

Seminar in Dynamical Systems, University of Colorado at Boulder, Feb. 18, 1999.

Stability of Periodic Solutions in the N-Body Problem: Rings, Kings and Other Fun Things

Job Talk, Colgate University, Feb. 10, 1999.

Job Talk, Connecticut College, Feb. 2, 1999.

Job Talk, Bloomsburg University, Jan. 28, 1999.

Relative Equilibria in the N-Body Problem

Semi-Annual Dynamical Systems and Related Topics Workshop, Penn State University, Oct. 8–11, 1998.

Dynamical Systems Seminar, Boston University, April 6, 1998.

The Reform Course in Differential Equations: A Teaching Fellow's Perspective

Workshops on Teaching Differential Equations with a Dynamical Systems Perspective, DePaul University, June 22–25, 1997 and Davidson College, June 1–4, 1997.

Research Visits to Other Institutions

- **Participant in a SQuaREs (Structured Quartet Research Ensembles) program entitled “Towards solving Smale’s sixth problem,” sponsored by the American Institute of Mathematics, Palo Alto, California, March 9–13, 2009.**
- **Visiting researcher at Wilfrid Laurier University, Waterloo, Ontario, Canada, December 2–5, 2008. Invited by Manuele Santoprete, Assistant Professor, Department of Mathematics.**
- **Visiting researcher at the Department of Mathematics at Brigham Young University, October 20–24, 2008. Invited by Lennard Bakker, Assistant Professor, Department of Mathematics.**
- Visiting researcher at Academia Sinica, Taipei, Taiwan, May 21–23, 2007. Invited by Yi-Chiuan Chen, Assistant Research Fellow, Institute of Mathematics.
- Visiting researcher at the University of Ontario Institute of Technology, Oshawa, Ontario, Canada, June 19–24, 2005. Invited by Pietro-Luciano Buono, Assistant Professor of Mathematics, Faculty of Science.

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- Visiting researcher at the University of Minnesota, Duluth, May 5–7, 2004. Collaborated with Bruce Peckham, Associate Professor, Department of Mathematics and Statistics.

Research with Undergraduates

- Shea Sennett, HC '10, Summer 2008, Fall 2009 – Spring 2010.
- Skyler Simmons, BYU '09, Fall 2008 – Spring 2009.
- Julianne Kulevich and Christopher J. Smith, HC '08, Summer 2007 – Spring 2008.
- Lisa Melanson, HC '06, Summer – Fall 2005.
- Trevor O'Brien, HC '05, Summer 2004 – Spring 2005.
- Gabe Weaver, HC '04, Summer 2002.
- Jeremy Horgan-Kobelski, University of Colorado, Boulder '02, Fall 2000 – Summer 2001.

Interviews Given

- J. Lawless, Paths to Knowledge, *Oberlin Alumni Magazine*, 12–17, Summer 2005.
- B. Cipra, *What's Happening in the Mathematical Sciences*, Vol. 5, P. Zorn ed., American Mathematical Society, Providence, RI, 2002.
- D. Mackenzie, NSF Moves With VIGRE to Force Changes in Academia, *Science* **296**, 1389–1390, May 24, 2002.

Computer Experience

Maple, Mathematica, Matlab, Pascal, Unix, \LaTeX , \TeX .

Miscellaneous

Member, **Blue Champagne Jazz Quartet (1 year)**, Worcester Chorus (7 years), Boston Pops Holiday Chorus (1 year), Choruses of the Worcester Consortium (1 year).

Hobbies: Biking, Jazz Piano, Soccer, Ultimate Frisbee.