Brenae L. Bailey

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RESEARCH INTERESTS AND PROFESSIONAL GOALS: develop and apply mathematical models of biophysical processes; support mathematics and science education through teaching, teacher training, curriculum development and outreach

EDUCATION:

Ph.D., Applied Mathematics, University of Arizona, 2013 (expected)
M.S., Applied Mathematics, University of Arizona, 2007
33 credits in Secondary Mathematics Education, University of Wyoming, 1996-1997
M.S., Physics (emphasis in Astrophysics), University of Wyoming, 1996
B.A., Mathematics, Oberlin College, 1992

TEACHING EXPERIENCE:

2012-present **Instructor,** Department of Mathematics, University of Arizona. Taught College Algebra, Calculus I, Statistics, and Understanding Elementary Mathematics. Supervised undergraduate course assistants for Statistics.

2012 **Consultant,** Tucson Unified School District, Tucson, Arizona. Worked with TUSD educators to update the high school mathematics curriculum to align with the new Common Core Standards.

2011 Worked with members of the Molecular and Cellular Biology Department, University of Arizona, to develop a new course in Quantitative Biology. Planned course goals and syllabus; researched relevant scientific papers to use as course readings; designed MATLAB graphical user interfaces to be used in course exercises.

2009-2010 **Fellow,** Graduate Students and Teachers Engaging in Mathematical Sciences (G-TEAMS), a National Science Foundation G-K12 program at the University of Arizona. Worked with a middle school math teacher to develop and improve math lessons and activities for 6^{th} grade, 7^{th} grade, and Math Intervention classes. Led activities in the classroom. Organized a field trip to the University of Arizona for the 7^{th} grade honors class.

2006-2007 **Fellow,** Collaboration to Advance Teaching Technology and Science (CATTS), a National Science Foundation G-K12 program at the University of Arizona. Worked with local 7^{th} grade science teachers to develop and present astronomy curricula. Also wrote math connections for a set of Hands-On Optics modules developed by the National Optical Astronomy Observatory and assisted with activities at three Hands-On Optics camps for middle school students.

2005-2011 **Graduate Teaching Assistant/Associate,** Program in Applied Mathematics, University of Arizona. Primary instructor for College Algebra and Understanding Elementary Mathematics; led discussion sections for Ordinary Differential Equations.

2000-2004 **Lecturer,** Department of Physics and Astronomy, University of Wyoming. Taught lectures, discussion sections and labs for first-year physics classes. Revised the lab manuals for Electricity, Magnetism and Optics and Conceptual Physics. Taught lecture classes in electricity, magnetism and optics, conceptual physics, and physical science for education majors. Served on departmental committees for undergraduate recruitment and retention. Also taught one section of College Algebra through the Department of Mathematics.

2000-2002 **Faculty,** Upward Bound/Math Science Initiative Project, University of Wyoming. Designed and taught six-week summer courses for high school students on statistics, calculus, physics, and astronomy.

2000-2001 **Instructor,** School of Extended Studies, University of Wyoming. Designed and taught courses in international folk dancing.

1997-1999 **Teacher,** Ivimila Secondary School, Plumtree, Zimbabwe as a Peace Corps Volunteer. Taught 8^{th}-10^{th} grade algebra, geometry, chemistry, and general science to classes of 35-50 students. Served as home room teacher and guidance counselor. Developed school science syllabus. Created charts and models for use as teaching aids. Ran school library. Organized and supervised Astronomy Club. Assisted choir, drama, sports, and Red Cross club practices and events. Assisted in training new Peace Corps Volunteers.

1997 **Substitute Teacher,** University of Wyoming Lab School. Taught 6^{th}-9^{th} grade algebra, geometry, biology, earth science, and social studies.

Assistant Lecturer, University of Wyoming. Assisted with summer course on physical science for teachers, including building and demonstrating simple models and maintaining class records.

1995-1997 **Faculty,** Creative Arts Institute, Laramie, Wyoming. Collaborated with other faculty members to create and present activities combining science and art for 1^{st}-6^{th} grade students in week-long summer programs.

1995 **Teaching Assistant,** Department of Physics and Astronomy, University of Wyoming. Taught two sections of a summer course on astronomy for teachers.

1990-1991 **Instructor,** Oberlin College. Taught two semesters of international folkdance through the Experimental College program.

1988-2012 **Tutor,** private and through Oberlin College, the University of Wyoming, the Adult Studies Resource Center of Laramie County Community College, and the University of Arizona. Tutored small groups and individuals from 5^{th} grade to adult in mathematics, physics, astronomy, and Russian.

SERVICE AND OTHER ACTIVITIES:

2012	**Judge,** Graduate and Professional Student Council Travel Grant applications.
2011, 2012	**Presenter,** Sonia Kovalevsky Day, Tucson, Arizona. Created and led workshops on topics in mathematics for high school girls.
2006, 2007, 2009	**Presenter,** Tucson Kids Clubs. Created and presented fun mathematics activities in half-day programs for 3^{rd}-6^{th} grade students.
2008	**Consultant,** Regional Science Center teacher workshop, Tucson, Arizona. Provided content support for a two-day teacher training workshop in astronomy.
2007	**Speaker,** Developing Job Skills in Science program at Pueblo High School, Tucson, Arizona. Gave motivational talks about science as a career aimed at low-achieving high school students.
2004	**Presenter,** Wyoming Astro Camp, Laramie, Wyoming. Assisted with activities on astronomy and rocket science at a summer camp for 6^{th}-9^{th} grade students.
1998	**Volunteer,** Habitat for Humanity International, Zimbabwe. Helped to build three houses in a rural area northwest of Harare.
1996-1997	**Laboratory Assistant,** Department of Geology, University of Wyoming. Catalogued the paleontology reprint collection using Filemaker Pro.
1992-1997	**Presenter,** Expanding Your Horizons program. Created and presented workshops in physics and astronomy for 5^{th}-12^{th} grade girls.
1986-present	Active in international folkdance groups: leading, teaching, and performing traditional dances from around the world.

RESEARCH EXPERIENCE:

2004-present	**Graduate Assistant/Associate,** Program in Applied Mathematics, University of Arizona. Projects have included non-Newtonian fluid flow, elasticity theory in cell membranes, coarsening phenomena in thin films, modeling of swarm behavior, electrohydrodynamics of a liquid crystal, orbital evolution of small bodies in the outer solar system, and ribosomal frameshifting in viral RNA translation.
2000	**Consultant,** Department of Physics and Astronomy, University of Wyoming. Revised a data analysis program for use on galaxy images at multiple wavelengths using IDL.
1992-1997	**Graduate Research Assistant,** Department of Physics and Astronomy, University of Wyoming. Work included sensitivity calculations and comparisons for five proposed astronomical observatories; image reduction and analysis of infrared, optical, and X-ray galaxy data; computer software installation; and observing at the Wyoming Infrared Observatory.
1991	**Undergraduate Research Assistant,** Department of Physics and Astronomy, University of Wyoming. Summer research experience in reduction and analysis of astronomical images.

PUBLICATIONS:

Bailey, B. L., Visscher, K. and Watkins, J. A stochastic model of translation with –1 programmed ribosomal frameshifting. Submitted.

Bailey, B. L. and Malhotra, R. (2009). Two dynamical classes of Centaurs. *Icarus, 203*, 155-163.

Dale, D. A., and **Bailey, B. L.** (2003). Physics in the art museum. *The Physics Teacher, 41*, 82-83.

Thronson, H. A., Rapp, D., **Bailey, B.**, and Hawarden, T. G. (1995). Ecological niches in infrared and sub-millimeter space astronomy: expected sensitivity as a function of observatory parameters. *Publications of the Astronomical Society of the Pacific, 107,* 1099-1118.

CONFERENCE PRESENTATIONS AND INVITED TALKS:

2012, April. Modeling RNA translation with frameshifts. Invited talk presented at the Quantitative Biology Colloquium, University of Arizona, Tucson, Arizona.
2012, January. Stochastic modeling of ribosomal frameshifting. Talk #2006 presented at the 2012 Joint Mathematics Meetings, Boston, Massachusetts.
2011, October. A stochastic model of RNA translation with frameshifting. Poster #F1.00046 presented at the American Physical Society Four Corners Section meeting, Tucson, Arizona. Awarded prize for Outstanding Graduate Poster.
2011, October. A stochastic model of RNA translation with frameshifting. Poster presented at the National Alliance Field of Dreams conference, Phoenix, Arizona.
2011, September. Using manipulatives in the classroom. Interactive talk at the G-TEAMS Seminar, University of Arizona, Tucson, Arizona.
2011, April. A stochastic model of programmed ribosomal frameshifting in viral protein synthesis. Invited talk at the Applied Dynamical Systems Seminar, Colorado State University, Ft. Collins, Colorado.
2010, February. G-TEAMS: graduate students and teachers engaging in mathematical sciences. Poster presented with Chantel Blackburn and Victor Piercey at the GK-12 Special Focus Meeting of the 2010 AAAS Annual Meeting, San Diego, California.
2008, October. The Centaur—Jupiter family comet link. Talk #38.04 presented at the 40th annual American Astronomical Society Division of Planetary Sciences conference, Ithaca, New York.
2007, October. Orbital evolution of Centaurs. Poster #52.02 presented at the 39th annual American Astronomical Society Division of Planetary Sciences conference, Orlando, Florida.
2003, May. The effectiveness of web-based homework in introductory mathematics and physics classes. A project presented at the 2003 Colloquium on Teaching with Technology, sponsored by the Ellbogen Center for Teaching and Learning, University of Wyoming, Laramie, Wyoming.
1992, January. A ROSAT survey of irregular galaxies. Poster #49.14 presented at the 181st American Astronomical Society meeting, Phoenix, Arizona, with H. A. Thronson, D. A. Hunter, A. Ksir, and R. Hickson.

UNIVERSITY PRESENTATIONS:

2012, April. Modeling RNA translation with frameshifts. Applied Math Brown Bag Seminar, University of Arizona, Tucson, Arizona.
2011, September. A stochastic model of programmed ribosomal frameshifting in viral protein synthesis. Biophysics Seminar, University of Arizona, Tucson, Arizona.
2010, April. Stochastic modeling of programmed ribosomal frameshifting in viral protein synthesis. Applied Math Brown Bag Seminar, University of Arizona, Tucson, Arizona.

2008, May. In the groove: mean motion resonances between Centaurs and the outer planets. 11th Lunar and Planetary Laboratory Conference, Tucson, Arizona.
2007, September. Orbital evolution of Centaurs: current explorations. Applied Mathematics Brown Bag Seminar, University of Arizona, Tucson, Arizona.
2007, May. Anomalous diffusion of Centaurs. 10th Lunar and Planetary Laboratory Conference, Tucson, Arizona.

HONORS AND AWARDS:

2012	Marshall Foundation Dissertation Fellowship, University of Arizona
2012	Graduate and Professional Student Council Travel Grant to attend Joint Mathematics Meetings, Boston, Massachusetts
2011	Award for Outstanding Poster, APS 4 Corners Section Meeting, Tucson, Arizona
2009-2010	NSF G-K12 G-TEAMS Fellowship, University of Arizona
2007	Herbert E. Carter Travel Award to attend AAS DPS Meeting, Orlando, Florida
2006-2007	NSF G-K12 CATTS Fellowship, University of Arizona
2004-2005	VIGRE Fellowship, Program in Applied Mathematics, University of Arizona
1997	Superior Student in Education Scholarship, University of Wyoming
1995	Exceptional Service Award, Dept. of Physics and Astronomy, University of Wyoming
1992-1993	NASA Space Grant Fellowship, University of Wyoming
1988	National Merit Scholarship, Oberlin College