

Keith E. Mellinger

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PROFESSIONAL EXPERIENCE

- **Director of the Quality Enhancement Plan**, 2013 – present. UMW.
- **Professor of Mathematics**, 2014 – present. Department of Mathematics, UMW.
- **Interim Director, Office of Academic and Career Services**, Fall 2013 – Spring 2014. UMW.
- **Associate Professor**, 2008 – 2014. Department of Mathematics, UMW.
- **Department Chair**, 2008 – 2013. Department of Mathematics, UMW.
- **Assistant Professor**, 2003 – 2008. Department of Mathematics, UMW.
- **Research Assistant Professor** (Vigre post-doc), 2001 - 2003. Department of Mathematics, Statistics, and Computer Science, University of Illinois at Chicago, Chicago, IL, 60607-7045. Position partially funded by a *VIGRE* grant from the National Science Foundation.

EDUCATION

- **Ph.D. in Mathematics**: August 2001, University of Delaware, Newark, DE.
– Thesis: *Mixed Partitions and Spreads of Projective Spaces*
- **M.S. in Mathematics**: May 1997, University of Delaware.
- **B.S. in Mathematics**: May 1995, Millersville University, Millersville, PA.
– minor in computer science, option in statistics

GRANTS AND AWARDS

- Millersville University Outstanding Young Alumni Achievement Award, presented by the alumni association at MU, May 2013.
- Mathematical Association of America's *Carl B. Allendoerfer Award* for the article, "Kirkman's Schoolgirls Wearing Hats and Walking Through Fields of Numbers" coauthored with Ezra Brown (VA Tech) and published in *Mathematics Magazine* in February 2009

- Sabbatical Leave for research in coding theory, graph theory, and finite geometry, fall 2010
- UMW Alumni Association Outstanding Young Faculty Award, 2008
- UMW Faculty Achievement Award, 2006
- Jepson Fellowship, UMW, 2006 – 2007 academic year
- National Security Agency, Young Investigator Grant #H98230-06-1-0080, \$25,576, 2005–2007
- Project NExT fellow (2004 – 2005), program sponsored by the Mathematical Association of American and partially funded by Exxon-Mobile
- Faculty Stipend, Jepson Summer Science Institute (Undergraduate Research Program), University of Mary Washington, summers 2004, 2005 and 2008
- UMW Faculty Development Grants (8 times), grants for summer research or course development
- UMW Undergraduate Research Grants (6 times)
- UMW Supplemental Travel Funding (23 times), for travel to professional meetings
- VIGRE (*Vertical Integration of Research and Education*) post-doctoral position at the University of Illinois at Chicago (2001 – 2003)

PUBLICATIONS

Research Papers

1. Small Kakeya Sets in Non-Prime Order Planes, with Jeremy Dover, to appear in *European J. Combinatorics*.
2. Graph embeddings in finite planes, with Ryan Vaughn and Oscar Vega, to appear in *Contributions to Discrete Mathematics*.
3. Some spectral results on Kakeya sets, with Jeremy Dover, to appear in *Advances in Geometry*.
4. Minimal Kakeya Sets, with Jeremy Dover and Kelly Scott*, *Journal of Combinatorial Designs*, **22**: 2 (February 2014) 95 – 104.
5. Embedding cycles in finite planes, with Felix Lazebnik and Oscar Vega, *Electronic Journal of Combinatorics*, **20**:3 (2013) 17 pages.
6. Blocking semiovals containing conics, with Jeremy Dover and Kenneth Wantz, *Advances in Geometry*, **13**: 1 (January 2013) 29 – 40.
7. Generalized Pellegrino caps, with Jeremy Dover and Kenneth Wantz, *Finite Fields and Their Applications*, **18**: 5 (September 2012) 946 - 955.
8. An Erdős-de Bruijn theorem for hypergraphs, with Dhruv Mubayi and Jacques Verstraëte, *Designs, Codes and Cryptography*, **65**: 3 (2012) 233 – 245.
9. Semiovals as unions of conics, with Jeremy Dover, *Innovations in Incidence Geometry*, **12** (2011) 61 – 83.

10. Minimal generators for BCH codes, with Jacob Farinholt*, *IIME Journal*, **13**: 4 (Spring 2011) 199 – 206.
11. Spreads, arcs, and multiple wavelength codes, with Tim Alderson, *Discrete Mathematics* **311**: 13 (6 July 2011) 1187 – 1196.
12. Classes of permutation arrays in finite projective spaces, with Tim Alderson, *International Journal of Information and Coding Theory* **1**: 4 (2010) 371 – 383.
13. LDPC codes arising from hyperovals, with Catherine Castleberry* and Katie Hunsberger*, *Bulletin of the Institute of Combinatorics and its Applications*, **58** (2010) 59 – 72.
14. On the number of k -gons in finite projective planes, with Felix Lazebnik and Oscar Vega, *Note di Matematica*, **29** suppl. 1 (2009) 135 – 152.
15. 2-Dimensional optical orthogonal codes from Singer groups, with Tim Alderson, *Discrete Applied Mathematics*, **157**: 14 (2009) 3008 – 3019.
16. Geometric constructions of optimal OOCs, with Tim Alderson, *Advances in the Mathematics of Communication*, **2**: 4 (2008) 451 – 467.
17. Partitions in finite geometry and related constant composition codes, with Tim Alderson, *Innovations in Incidence Geometry*, **8** (2008) 49 – 71.
18. Classes of optical orthogonal codes from arcs in root subspaces, with Tim Alderson, *Discrete Mathematics*, **308**: 7 (2008) 1093 – 1101.
19. Families of optimal OOCs with $\lambda = 2$, with Tim Alderson, *I.E.E.E. Transactions on Information Theory*, **54**: 8 (August 2008) 3722 – 3724.
20. Optical Orthogonal Codes from Singer Groups, with Tim Alderson, in the book *Advances in Coding Theory and Cryptography*, Series on Coding Theory and Cryptology, 2. World Scientific Publishing Co. Pte. Ltd., Hackensack, NJ (2007) 51 – 70.
21. Mixed partitions and related designs, with Gary Ebert, *Designs, Codes and Cryptography*, **44**: 1-3 (2007) 15 – 23.
22. Constructions of optical orthogonal codes from finite geometry, with Tim Alderson, *SIAM Journal on Discrete Mathematics* **21**: 3 (2007) 785 – 793.
23. Classes of LDPC codes from quadratic surfaces of $PG(3, q)$, *Contributions to Discrete Mathematics*, **2**: 1 (2007) 35 – 42.
24. Small weight codewords in LDPC codes defined by (dual) classical generalized quadrangles, with Jon-Lark Kim and Leo Storme, *Designs, Codes and Cryptography*, **42**: 1 (2007) 73 – 92.
25. A new class of LDPC codes in $PG(4, q)$, with Jennifer Stovall*, *IIME Journal*, **12**: 5 (2006) 289 – 295.
26. LDPC codes generated by conics in the classical projective plane, with Sean Droms* and Chris Meyer*, *Designs, Codes and Cryptography*, **40**: 3 (2006) 343 – 356.
27. A new construction of extremal bipartite graphs from finite geometry, with Dhruv Mubayi, *Journal of Graph Theory*, **49**: 1 (2005) 1 – 10.

28. Classification of triply-retractable semifields of order q^4 , with Norman Johnson, *Journal of Geometry*, **80** (2004) 121 – 135.
29. Mixed partitions of $PG(3, q^2)$, *Finite Fields and Their Applications*, **10**: 4 (2004) 626 – 635.
30. LDPC Codes from triangle-free line sets, *Designs, Codes, and Cryptography*, **32**: 1-3 (2004) 341 – 350.
31. Classical mixed partitions, *Discrete Mathematics*, **283**: 1-3 (2004) 267 – 271.
32. Odd order flag-transitive planes of dimension three over their kernel, with Ronald Baker, Craig Culbert, and Gary Ebert, *Advances in Geometry*, (2003) S215 – S223.
33. Projections of binary linear codes onto larger fields, with Jon-Lark Kim and Vera Pless, *SIAM Journal on Discrete Mathematics*, **16**:4 (2003) 591 – 603.
34. Multiple spread retraction, with Norman Johnson, *Advances in Geometry*, **3**:3 (2003) 263 – 286.
35. A geometric relationship between equivalent spreads, *Designs, Codes and Cryptography*, **30**:1 (2003) 63 – 71.
36. A note on line-Baer subspace partitions of $PG(3, 4)$, *Journal of Geometry*, **72** (2001) 128 – 131.

Pedagogical and Expository Papers

1. The spider and the fly, with Raymond Viglione, *Classroom Capsules* section of the *College Mathematics Journal*, **43**: 2 (2012) 169 – 173.
2. Kirkman’s schoolgirls wearing hats and walking through fields of numbers, with Ezra Brown, *Mathematics Magazine*, **82**: 1 (2009) 3 – 15.
3. Advice for Graduating Ph.D. Students, with Felix Lazebnik, *FOCUS* - the newsletter of the Mathematical Association of America, **26**: 6 Aug/Sept (2006) 14 – 15.
4. Structuring undergraduate research in abstract algebra, with Hisaya Tsutsui, *Missouri Journal of Mathematical Sciences*, **18**: 3 (2006) 206 – 212.
5. Ordering elements and subsets, a classroom extension of standard counting, *Journal of Mathematics and Computer Education*, **38**: 3 (2004) 333 – 337.
6. Designs, geometry, and a golfer’s dilemma, *Mathematics Magazine*, **77**: 4 (2004) 275 – 282.

* indicates student coauthors

CONFERENCE/SESSION ORGANIZATION

- 3rd Annual Conference for the Exchange of Mathematical Ideas, co-organizer with Hisaya Tsutsui (ERAU) and Doug Muparisi (N. Iowa), held at the University of Mary Washington, Fredericksburg, VA, June 2015.

- 2nd Annual Conference for the Exchange of Mathematical Ideas, co-organizer with Hisaya Tsutsui (ERAU) and Doug Muparisi (N. Iowa), held at the University of Northern Iowa, Cedar Falls, IA, June 2013.
- 1st Annual Conference for the Exchange of Mathematical Ideas, co-organizer with Hisaya Tsutsui (ERAU) and Doug Muparisi (N. Iowa), held at Embry-Riddle Aeronautical University, Prescott, AZ, June 2012.
- Spring MD-DC-VA regional meeting of the Mathematical Association of American, co-host with Randall Helmstutler, UMW, April 2009.
- CTUM Contributed Paper Session on *Strategies to Encourage Persistence in Mathematics*, co-organizer with David Carothers (JMU) and Ahmed Zayed (DePaul), at the Joint Mathematics Meetings, San Antonio, TX, 2006.
- Session on Incorporating History into our Undergraduate Courses, with David Perkins (Houghton College), at Mathfest, Albuquerque, NM, 2005.
- Special Session on *Designs, Codes, and Geometries*, co-organizer with Q. Xiang (Delaware) and J. Davis (Richmond), at the Spring Eastern Section Meeting of the AMS, Newark, DE, 2005.
- Central Virginia Regional Conference for Undergraduate Research in Mathematics, co-organizer with Debra Hydorn, UMW, January 2005.

PROFESSIONAL PRESENTATIONS (LAST FIVE YEARS)

- *Mathematics and Music a harmonious connection*, invited keynote address at the annual honors and awards banquet, Department of Mathematics, Millersville University, May 2015.
- *The Journey from finite geometry to application*, invited address at the Winter Research Symposium, Department of Mathematical Sciences, University of Delaware, February 2015.
- *Mathematics and Music a harmonious connection*, invited talk at the Mary Washington ElderStudy, December 2014.
- *Eigentriads a musical offering*, invited departmental colloquium, Randolph-Macon College, October 2014.
- *Minimal Keakeya Sets*, invited Discrete Mathematics Seminar talk, Virginia Commonwealth University, September 2014.
- *Minimal Keakeya Sets*, contributed talk at the 24th British Combinatorial Conference, Royal Holloway - University of London, London, England, July 2013.
- *Blocking Semiovals and Their Applications in Cryptography*, contributed talk at the 2nd Annual Conference for the Exchange of Mathematical Ideas, University of Northern Iowa, Cedar Falls, IA, June 2013.
- *Eigenvectors - a musical offering*, contributed talk at the MD-DC-VA regional meeting of the Mathematical Association of America, Salisbury University, April 2013.

- *Student Centered Learning and Higher Expectations for the Mathematics Major*, presentation at the COPLAC summer faculty institute for liberal learning in the disciplines, Asheville, NC, June 2012.
- *Anti-blocking Sets*, invited speaker at the 14th Annual Discrete Math Days, Colorado State University, Fort Collins, CO, May 2012.
- *Applications of Pencils of Conics*, invited discrete mathematics seminar, University of Delaware, May 2012.
- *Blocking Semiovals and Cryptology*, invited speaker at the Combinatorics, Algebra and Geometry Seminar, George Mason University, November 2011.
- *Teaching Problem solving for undergraduates with no prerequisite*, contributed talk at the MD-DC-VA regional meeting of the Mathematical Association of America, Christopher Newport University, November 2011.
- *Problem solving with no prerequisites*, session on first-year experiences at Mathfest, Lexington, KY, August 2011.

PROFESSIONAL MEMBERSHIPS

- American Mathematical Society (AMS), 1995 to present
- Mathematical Association of America (MAA), 1995 to present
- Society for Industrial and Applied Mathematics (SIAM), 2004 – 2008
- Institute of Combinatorics and its Applications, 2008 to present

TEACHING EXPERIENCE

- At the University of Mary Washington
 - First-year Seminar: Pirates, Liars, and Pigeons (FSEM 100 - co-developed)
 - First-year Seminar: Cryptology (FSEM 100 - developed)
 - Precalculus (Math 111)
 - Calculus I, II, and III (Math 121, 122, 223)
 - Introduction to Statistics (Math 200)
 - Introduction to Discrete Mathematics (Math 201)
 - Discrete Mathematics (Math 325)
 - Modern Geometry (Math 372)
 - Abstract Algebra I & II (Math 431, 432)
 - Coding and Cryptography (Math 461 - developed)
 - Senior Problem Solving Seminar (developed)
 - Independent studies in cryptology, combinatorics, complex analysis, coding theory, and graph theory
- At UMW, courses for working teachers

- Geometry for Highly Qualified Middle School Teachers - evening professional development course
- Discrete Mathematics for Teachers (MAED 520 - developed)
- Geometry for Teachers (MAED 560 - developed)
- Problem Solving Workshop - weekend professional development course (developed)
- At the University of Illinois at Chicago (2001 – 2003)
 - Honors Calculus II (MTH 181), Discrete Mathematics (MCS 261), Computer Algorithms (MCS 401), Graph Theory (MCS 423), Independent studies in design theory, finite geometry, and generating functions
- At the University of Delaware (1995 – 2001)
 - Mathematics for Elementary Education I & II (Math 251-252), College Math and Statistics (Math 140), Calculus for the Social Sciences (Math 221), Calculus I & II (Math 241 - 242), Finite Mathematics (Math 230), Discrete Mathematics (Math 210)

STUDENT RESEARCH AND HONORS PROJECTS

- UMW student Alaina Morello, fall 2014
Clifford embeddings: a problem in quantum coding theory
- UMW student Kelly Scott, spring 2012
Anti-blocking sets in projective planes, published in the *Journal of Combinatorial Designs*
- UMW student Kelsie Snyder, spring 2011
c-Dominating sets for families of graphs, published in the journal *Metamorphosis*
- UMW MAED student Carrie Lowry, summer and fall 2009
Deletion-correcting properties for classes of error-correcting codes
- UMW student Katie Hunsburger, fall 2008 and spring 2009
The weight enumerator for a class of LDPC codes based on hyperovals
- UMW student Jake Farinholt, fall 2008 and spring 2009
Designing codes to fit your needs: a closer look at the Bose-Chaudhuri-Hocquenghem (BCH) codes, published in the *IIME Journal*
- UMW student Christine Exley, fall 2008 and spring 2009
Cryptography based on determining sets
- UMW students Katie Hunsberger and Catherine Castleberry, summer 2008
Coding the Cryptography with Hyperovals of $PG(2, 2^s)$, published in the *Bulletin of the Institute of Combinatorics and its Applications*
- UMW student Elizabeth Liskom, fall 2007 and spring 2008
Teaching Geometry with *The Geometer's Sketchpad*
- UMW student Ryan Johnson, fall 2006 and spring 2007
Investigation of a min-max scheduling problem

- UMW student Chris Meyer, fall 2005
Codes generated by matrix expansions, published in the *Morehead Electronic Journal of Applicable Mathematics*, issue 5, May 2007.
- UMW students Sean Droms and Chris Meyer, summer 2005
LDPC codes generated from conics in the classical projective plane, published in *Designs, Codes and Cryptography*
- UMW student Amanda Passmore, spring 2005
An elementary solution to the ménage problem
- UMW student Jennifer Stovall, fall 2004
A new class of LDPC codes in $PG(4, q)$, published in the *IIME Journal*
- UMW students Jennifer Stovall and Amanda Passmore, summer 2004
On codes generated from quadratic surfaces in $PG(3, q)$, published in the *Rose-Hulman Institute of Technology Undergraduate Mathematics Journal*, **5**: 4 (2004).
- UIC student Monika Rut, summer 2002
Combinatorial Designs and Scheduling Golf, published in the *UIC Scientific Undergraduate Research Journal*, 2001.
- Several problem solutions by the *Mary Washington Problem Solving Group* published in the MAA journal *Horizons*

REVIEWING AND REFEREEING

- Referee for Research Journals
 - *Ars Combinatoria*, *Contributions to Discrete Mathematics*, *Discrete Mathematics, I.E.E.E. (Institute of Electrical and Electronics Engineers) Transactions on Information Theory*, *Virginia Journal of Sciences*, *AKCE International Journal of Graphs and Combinatorics*, *Journal of Applied Mathematics and Computing*, *Journal of Pure and Applied Algebra*, *Information Sciences*
- Mathematical Reviews - completed 31 reviews to date
- Book reviews for: Houghton Mifflin, Prentice Hall, Wiley

ADMINISTRATIVE APPOINTMENTS

- Director of the Quality Enhancement Plan (2013 – present)
 - organize and present at a variety of on-campus events to support the mission of the QEP
 - work with students and staff in the academic support areas on the development of on-line learning modules
 - oversee a variety of assessment activities for reporting to SACS
- Interim Director - Office of Academic and Career Services (6 months in 2013 – 2014)

- oversee all aspects of academic services and career services
- receive and vet a variety of requests for exceptions to university policies
- supervise and evaluate nine staff members
- Mathematics Department Chair (2008 – 2013)
 - supervise a department of 14 tenure or tenure-track faculty, about 15 adjunct faculty and one office manager
 - lead all aspects of our programs with approximately 100 mathematics majors and 30 minors, plus a robust offering of general education courses
 - support recruiting and outreach through UMW admissions, our annual high school calculus tournament, and a variety of departmental publications

SERVICE

- University level
 - University Academic Affairs Committee, 2014 – 2017
 - Committee on Academic Standing, 2014 – present
 - University Faculty Affairs Committee, 2011 – 2014 (chair '11 – '13)
 - Enrollment Management Committee, 2012-2013
 - CAS Faculty Affairs Committee, 2006 – 2009 (chair '07 – '08), 2011 – 2014
 - Undergraduate Research Task Force, 2011 – 2012
 - Task Group on General Education, summer 2007
 - First-Year Seminar Committee, 2004 – 2008, acting chair or co-chair
 - Grants Advisory Committee, 2006 – 2008
 - Faculty Senator, 2004 – 2006
 - Undergraduate Research & Creativity Day planning committee, spring 2007
- Community
 - Member of the STEM16 subgroup of the Fredericksburg area Chamber of Commerce, 2011 – present
 - Supplier of problems for the *Free-Lance Star's* Weekly Challenge, 2009 – 2011
 - Mathematical content consultant for PBS show *CyberChase* (an educational show for children ages 8 – 11), review about 4 briefs or scripts each year, 2001 – present
 - Moderator for UMW High School Calculus Tournament, 2008 – present
 - Reader for Virginia Junior Academy of Sciences student paper competition, 2004, 2005, 2007, 2008
 - Oral Judging for Regional High School Mathematics Contest, Chicago, IL, 2002