

## CATHERINE MADER

Professor of Physics  
Department of Physics, Hope College  
Holland, Michigan 49423  
(616) 395-7114, EMAIL:MADER@hope.edu

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### PROFESSIONAL PREPARATION

**Michigan State University**, Ph.D., Physics, 1993.

*Equilibrium and Non-Equilibrium Models for Particle Production in Heavy Ion Collisions*

**Colorado School of Mines**, M.Sc., Engineering Physics, 1989.

*Sub-Coulomb Deuteron-Nucleus Collisions Using the Cayley Equation*

**Colorado School of Mines**, B.Sc., Engineering Physics, Nuclear Energy (minor) 1987.

### APPOINTMENTS

#### Hope College

Director, Day1 Programs	2014 – present
Director, Hope College HHMI programs	2012 – 2106
Professor	2008 – present
Chair, Department of Physics	2006 – 2009
Chair, Department of Physics & Engineering	2005 – 2006
Acting Chair, Department of Physics & Engineering	2004 – 2005
Associate Professor	1999 – 2009
Assistant Professor	1994 – 1999
Visiting Assistant Professor	1993 – 1994

#### American Physical Society

Education Project Consultant	2007 – 2012
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#### Lawrence Berkeley National Laboratory

Visiting Scientist	2000 – 2001
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### PROFESSIONAL MEMBERSHIPS

American Association of Physics Teachers	Sigma Xi
American Physical Society	NSF Physics REU Leadership Group
American Physical Society - Division of Nuclear Physics	Council on Undergraduate Research
Project Kaleidoscope Faculty 21	Society of Physics Students
American Association of University Women	ΣΠΣ

### PROFESSIONAL ACTIVITIES

Organized the 2016 NSF Physics REU Workshop (October 2016)  
Organized two workshops on course-based research experience curriculum development in 2013, 2014  
Organized the 2016 HHMI Constellation Studio: “Implementing Course-Based Research Experiences at Scale: Building the Value Proposition” (November 2016)  
NSF Physics REU Leadership Group Executive Committee member and chair (2008 – 2012, 2016 – present)  
American Institute of Physics - Education Advisory Committee (2013 – 2016), chair (May 2013 – January 2016)

American Physical Society - Division of Nuclear Physics Education Committee (2011 – September 2015)  
 American Physical Society Committee on Careers and Professional Development member (2009 – 2011),  
 committee chair (2010 – 2011)  
 Advancing the Careers of Women in Science, Technology, Engineering, and Mathematics at  
 Predominantly Undergraduate Institutions through Professional Networks participant (2012 – 2016)  
 Society of Physics Students Zone Councilor (2005 – 2007)  
 HHMI CRE Collaboration project leader (2013 – present)  
 Reviewer for several NSF grant programs; NSF Physics Committee of Visitors (2015 ; Research  
 Corporation; P-Kal grant programs and conferences; Project SPIN-UP; American Journal of Physics;  
 Howard Hughes Medical Institute; textbooks; External Departmental reviewer for several colleges  
 Council on Undergraduate Research (2006-present), CUR Physics and Astronomy Councilor and  
 Nominations Committee member (2006-2009)  
 Organized the 2008 NSF Physics REU Workshop and several APS conference sessions on the topic

## GRANTS AND AWARDS

- 2016 NSF Grant: *Physics REU Directors' Workshop*
- 2014 Herbert H. and Grace A. Dow foundation: *Meeting the Persistent Challenges Recruiting, Retaining, and Graduating Michigan STEM students*
- 2013 Howard Hughes Medical Institute Award: *Pilot grant: The Phage Model Goes Viral: Developing Other Models for Course-based Research Experiences (CREs)*
- 2012 Michigan Space Grant Consortium Grant: *Hope College Watershed Science Academies and Work shops*
- 2012 Howard Hughes Medical Institute Award: *Strengthening the Pathway to STEM Research Leadership at Hope College*
- 2012 NSF S-STEM Grant: *Scholarships for Transfer Students in Science, Engineering, and Mathematics*
- 2010 NSF S-STEM Grant: *Scholarships to support the Hope STEM Scholars Program participants*
- 2010 NSF-ARI Grant: *Providing STEM Research Infrastructure for VanderWerf Hall at Hope College*
- 2009 AIP Meggers Project Award: *Hope College Nuclear Forensics Workshops for High School Teachers*
- 2008 NSF Grant: *Physics REU Directors' Workshop*
- 2007 Michigan Space Grant Consortium Grant: *Hope Creative Science Initiative Outreach Program*
- 2005 NSF-REU Grant: *Research Experiences for Undergraduates in Physics and Engineering at Hope College*
- 2003 NSF-CCLI Grant: *Adaptation of "6 Ideas that Shaped Physics" for Life-Sciences Majors at Hope College*
- 1998 NSF-RUI Grant: *Theoretical Study of the Space-time Evolution of Heavy-Ion Collisions at Hope College*
- 1997 Hope College - Howard Hughes Medical Institute Faculty Development Grant: *Theoretical Studies in Nuclear Physics*
- 1995 NSF-RUI Grant: *Theoretical Study of the Space-time Evolution of Heavy-Ion Collisions at Hope College*
- 1995 Research Corporation Cottrell College Science Award: *A study of the space-time evolution of the hadronic reaction zone formed in heavy-ion collisions*
- 1994 Hope College Howard Hughes Medical Institute Program: *Full-scale implementation of Computer- Assisted Personalized Assignments (CAPA) in the General Physics course*
- 1993 Michigan State University, Department of Physics and Astronomy, *Sherwood K. Haynes Award for Outstanding Graduate Student of 1993-1994*
- 1992 Michigan State University, Department of Physics and Astronomy, *1991-1992 Outreach Award for Science Theatre*

**PUBLICATIONS**  
(UNDERGRADUATES INDICATED WITH \*)

- C. M. Mader, C.W. Beck, W. H. Grillo, G. P. Hollowell, B. S. Hennington, N. L. Staub, V. A. Delesalle, D. Lello, R. B. Merritt, G. D. Griffin, C. Bradford, J. Mao, L. S. Blumer, S.L. White. "Multi-Institutional, Multidisciplinary Study of the Impact of Course-based Research Experiences", submitted Journal of Microbiology & Biology Education.
- S. Scogin and C. M. Mader. "Building Science Capacity in Undergraduate Students: A Cross-Case Comparison of Course-Based Undergraduate Research Experiences", submitted, Science Education.
- P. M. DiBartolo, L. Gregg-Jolly, D. Gross, C. A. Manduca, W. Iverson, D. B. Cooke, G. K. Davis, C. Davidson, P. E. Hertz, L. Hibbard, S. K. Ireland, C. Mader, A. Pai, S. Raps, K. Siwicki, and J. E. Swartz. "Principles and Practices Fostering Inclusive Excellence: Lessons from the Howard Hughes Medical Institute's Capstone Institutions", CBE Life Sci Educ vol. 15 no. 3 ar44
- N. L. Staub, L. S. Blumer, C. W. Beck, V.A. Delesalle, G. D. Griffin, R. B. Merritt, B. S. Hennington, W. H. Grillo, G. P. Hollowell, S. L. White, and C. M. Mader. "Course-based Science Research Promotes Learning in Diverse Students at Diverse Institutions", Council for Undergraduate Research Quarterly, Council for Undergraduate Research Quarterly 37.2 . (2016).
- C. M. Mader, ed. "The Physics Research Mentor Training Seminar" manual, American Physical Society, 2011. <http://www.aps.org/programs/education/undergrad/faculty/mentor-training.cfm>
- C. C. Barney, C. Mader, K. A. Winnett-Murray, L. Hertel, and A. DeWeerd. "BioOptics corporation: An investigative interdisciplinary case study on the eye." Tested Studies for Laboratory Teaching, Volume 30 (K.L. Clase, Editor) Proceedings of the 30th Workshop/Conference of the Association for Biology Laboratory Education (ABLE), p 195-223 (2009).
- J. Krupczak, Jr., J. Kaloust, M. Misovich, J. Pawloski, R. Veldman, P. DeYoung, P. Gonthier, C. M. Mader, and M. Little, "Results from Replacing General Physics with Introduction to Engineering in the First Year", Proceedings of the American Society for Engineering Education Annual Conference (2004).
- C. M. Mader, A. Chappars\*, J. B. Elliot, L. G. Moretto, L. Phair, G. J. Wozniak, "The three-dimensional Ising model: A paradigm of liquid-vapor coexistence in nuclear multifragmentation", Phys. Rev. C68, 064601 (2003).
- L. G. Moretto, J. B. Elliot, L. Phair, G. J. Wozniak, C. M. Mader, A. Chappars\*, "Theoretical approaches and experimental evidence for liquid-vapor phase transitions in nuclei", AIP Conference Proceedings, April 2, 2002 610, 182-196 (2002).
- G. F. Peaslee, C. M. Mader, P. L. Jolivet, P. A. DeYoung, "The Restructured Advanced Laboratory at Hope College - A Step Toward Independence"; Application of Accelerators in Research and Industry: 15th International Conference, AIP Press 475, 1110-1113 (1999).
- P. A. DeYoung, et. al., C. Dykstra, P. Gonthier, C. Mader, G. F. Peaslee, D. Peterson, R. Sedlar, S. Sundbeck, N. Shaw, G. D. Westfall, D. Craig, R. A. Lacey, T. Li, T. Reposeur, A. M. Vander Molen, J. Winfield, S. J. Yennello, A. Nadasen, "Sensitivity of small-angle correlations of light charged particles to reaction mechanisms in the  $^{16}\text{O} + ^{27}\text{Al}$  Reaction at 44 MeV/nucleon"; Phys. Rev. C56, 244 (1997).
- P. A. DeYoung, et. al., R. Bennink, T. Butler, W. Chung, C. Dykstra, G. Gilfoyle, J. Hinnefeld, M. Kaplan, J. J. Kolata, R. A. Kryger, J. Kugi, C. Mader, M. Nimchek, P. Santi, A. Snyder, "Small Angle Neutron-Neutron Correlation Functions for the  $^{16}\text{O} + ^{27}\text{Al}$  Reaction at 220 MeV"; Nuc. Phys. A597, 127 (1996).
- W. J. Llope, et. al., W. Bauer, D. Craig, E. Gualtieri, S. Hannuschke, R. A. Lacey, J. Lauret, T. Li, C. M. Mader, A. Nadasen, E. Norbeck, R. Pak, G. Peilert, N. T. B. Stone, A. M. Vander Molen, G. Westfall, J. Yee, and S. J. Yennello, "Sphericity of central heavy-ion reactions."; Phys. Rev. C52, 1 (1995).
- W. J. Llope, et. al., J. A. Conrad, C. M. Mader, G. Peilert, W. Bauer, D. Craig, E. Gualtieri, S. Hannuschke, R. A. Lacey, J. Lauret, T. Li, A. Nadasen, E. Norbeck, R. Pak, N. T. B. Stone, A. M.

- Vander Molen, G. D. Westfall, J. Yee, and S. J. Yennello, "Autocorrelations and Intermediate-Mass-Fragment Multiplicities in Central Heavy-Ion Collisions"; Phys. Rev. C51, 1325 (1995).
- D. O. Handzy, et. al., M. A. Lisa, C. K. Gelbke, W. Bauer, F. C. Daffin, T. Decowski, W. Gong, E. Gualtieri, S. Hannuschke, R. Lacey, T. Li, W. G. Lynch, C. M. Mader, G. F. Peaslee, T. Reposeur, A. M. Vander Molen, G. D. Westfall, J. Yee and S. J. Yennello, "Two-proton Correlation Functions for  $^{36}\text{Ar} + ^{45}\text{Sc}$  at  $E/A = 80$  MeV", Phys. Rev. C50, 858 (1993).
- G. F. Peaslee, et. al., "Energy Dependence of Multifragmentation in  $^{84}\text{Kr} + ^{197}\text{Au}$  Reactions"; Phys. Rev. C49, R2271 (1993).
- M. A. Lisa, et. al., "Impact Parameter Selected Two-Proton Intensity Interferometry for  $^{36}\text{Ar} + ^{45}\text{Sc}$  at  $E/A = 80$  MeV"; Phys. Rev. Lett. 70, 3709 (1993).
- C. M. Mader, W. Bauer, "Impact Parameter Dependence of Two-proton Correlation Functions", Ninth Winter Workshop on Nuclear Dynamics, Key West, Florida, January 30-February 6, 86 (1993), World Scientific.
- D. R. Bowman, et. al., "Intermediate Mass Fragment Emission as a Probe of Nuclear Dynamics"; Phys. Rev. C46, 1834 (1992).
- C. M. Mader, W. Bauer, G. D. Westfall, " $K/\pi$  Ratios in Relativistic Heavy Ion Collisions"; Eighth Winter Workshop on Nuclear Dynamics, Jackson Hole, Wyoming, January 18-25, 286 (1992), World Scientific.
- C. M. Mader, W. Bauer, and G. D. Westfall, " $K/\pi$  Ratios in Relativistic Heavy Ion Collisions"; Phys. Rev. C45, 2438 (1992).
- C. M. Mader, "Equilibrium and Non-Equilibrium Models for Particle Production in Heavy Ion Collisions"; Ph.D. Thesis, 1993, unpublished.
- C. M. Mader, "Sub-Coulomb Deuteron-Nucleus Collisions Using the Cayley Equation"; Ms. Sc. Thesis, 1987, unpublished.

## PRESENTATIONS

- "Creating the Day1 Research Community Programs", Higher Education Institution STEM Summit for the Herbert H. and Grace A. Dow Foundation, May 2016.
- "Integrating Undergraduate Research into Courses", GLCA Webinar, March 2015.
- "Nuclear Forensics", Andrews University Physics Department Colloquium, January 2015.
- "Key Elements for Course-based Research Experiences", CUREnet Workshop (Course-Based Undergraduate Research Experience), Bowie State University, November 2014.
- "A Seven-Institution Collaboration to Develop Novel Course-Based Research Experiences for Undergraduates", CUR National Meeting, 2014.
- "Hope College Watershed Academies and Workshops" Annual Fall Conference of the Michigan Space Grant Consortium November, 2013.
- "Teaching Nuclear Science Using Case Studies in Nuclear Forensics", workshops for High School science teachers at Hope College, November, 2011.
- "Nuclear Forensics-Related Radiodating Activities and Experiments for the High School Classroom", ChemEd2011, July, 2011.
- "Teaching nuclear science using hands-on, interactive lessons in nuclear forensics", ChemEd2011, July 2011.
- "Nuclear Forensics for High School Science", APS April Meeting 2011.
- "Physics REU sites: What works? How do we know? How do we improve?", Invited talk, APS April Meeting 2011.
- "Teaching Nuclear Science Using Case Studies in Nuclear Forensics", Michigan AAPT, April, 2011.
- "Teaching nuclear science using hands-on, interactive lessons in nuclear forensics", Michigan Science Teachers Association, February 2011.
- "Finding Research Opportunities for Undergraduates", APS Career Webinar, January, 2011.

“Teaching Nuclear Science Using Case Studies in Nuclear Forensics”, one-day workshop for High School science teachers at Hope College, October, 2010.

“Careers for Physicists”, University of Wisconsin, River Falls Department Awards Banquet, March 2010.

“Teaching Nuclear Science Using Case Studies in Nuclear Forensics”, two-day workshop for High School science teachers at Hope College, February and April, 2010.

“Careers for Physicists”, 2009 APS April Meeting, Future Physicists Day Luncheon, April 2009.

“Nuclear Science + Forensics = N-CSI?”, Departmental seminar at Grand Valley State University, November 2008.

“Careers for Physicists”, 2008 AAPT/APS Physics Department Chairs Conference.

“Nuclear Science + Forensics = N-CSI?”, Departmental seminar at James Madison University, April 2008.

“Modifying “Six Ideas that Shaped Physic” for a Life-Science major audience at Hope College”, American Association of Physics Teachers Summer meeting, July 2005.

“Theoretical Nuclear Physics at Hope College”, Kavli Institute for Theoretical Physics workshop on Theoretical Physics research at PUIs, July, 2003.

“Hope College: Preparing future STEM leaders via undergraduate research and interdisciplinary studies”, C. Barney, J. Andersen, L. Chase, M. Seymore, C. Mader, P-Kal Assembly on Motivating Students to Pursue Careers in STEM Fields, August 2003.

2001 Spring meeting of the American Chemical Society. C. M. Mader, “Understanding the liquid- vapor coexistence in nuclear multifragmentation using the 3-dimensional Ising model”, April 3, 2001.

Departmental Seminar at the Colorado School of Mines. C. M. Mader, “Understanding the liquid- vapor coexistence in nuclear multifragmentation using the 3-dimensional Ising model”, March 27, 2001.

Nuclear Theory Seminar at Lawrence Berkeley National Laboratory. C. M. Mader, “Flow and Correlation Studies using the BUU Hadronic Transport Model”, August 5, 1999.

P-Kal Faculty for the 21st Century National Assembly. C. M. Mader, G. F. Peaslee, E. Sanford, “Building and Sustaining a Successful Research Program at Hope College”, September, 1998.

1998 Spring meeting of the American Physics Society. C. M. Mader, M. Nelson, “Pion Correlations in Relativistic Heavy Ion Collisions”, Bulletin of the American Physical Society, 43 (1998) 1177.

Departmental Seminar at Calvin College. C. M. Mader, “Nuclear Temperatures and Pressures: How do we measure them and what do we learn from them?”, November, 25, 1997.

Departmental Seminar at Ball State University. C. M. Mader, “Probing the Nuclear Equation of State through Heavy-Ion Reactions”, March 27, 1997.

1997 Summer meeting of the American Association of Physics Teachers. C. M. Mader, “Introductory Physics Reform at Hope College”, American AAPT Announcer, 27 (1997) 126.

1993 Annual Meeting of the American Physical Society Division of Nuclear Physics, C. M. Mader, W. Bauer, “Two-Particle Intensity Interferometry”, Bulletin of the APS, 38 (1993) 1848.

1992 Annual Meeting of the American Physical Society Division of Nuclear Physics, C. M. Mader, W. Bauer, “Two-Proton Intensity Interferometry”, Bulletin of the APS, 37 (1993) 1300.

1991 Annual Meeting of the American Physical Society Division of Nuclear Physics, C. M. Mader, W. Bauer, G. D. Westfall, “K/π ratios in Relativistic Heavy Ion Collisions using the Nuclear Firestreak model.” Bulletin of the APS, 36 (1991) 2146.

## **WEBSITES AND OTHER PRODUCTS**

“Implementing Course-Based Research Experiences at Scale: Building the Value Proposition: Summary Report”, Patricia Soochan and Susan Musante, March 2017:  
[https://www.hhmi.org/sites/default/files/PPDF16\\_SummaryReport\\_030917\\_1.pdf](https://www.hhmi.org/sites/default/files/PPDF16_SummaryReport_030917_1.pdf)

“NSF Physics Reu Site Directors Workshop” report, Gabe Popkin:  
<https://www.aps.org/programs/education/undergrad/physicsreu/conferences/2016/upload/REU-Workshop-Report-2016.pdf>

“Day1 Research Communities”: <http://www.hope.edu/academics/day1/>

“HHMI CRE Collaboration”: <https://sites.google.com/a/hope.edu/hhmi-cre/>

Multiple listings for Course-based Research Experiences at the CUREnet website:

<https://curenet.cns.utexas.edu/users/maderhopeedu>

“Supporting STEM Success in the Liberal Arts Context”:

<http://serc.carleton.edu/liberalarts/capstones/hope/>

“Physics REU Leadership Group”: <http://www.aps.org/programs/education/undergrad/physicsreu/> (now managed by APS staff)

“Physics Career Resource”: <http://www.compadre.org/careers/> (now managed by APS staff)

“Future of Physics Days”: <http://www.aps.org/meetings/events/futurephysics/index.cfm> (now managed by APS staff)

“Insight: Physics Slide Shows”: <http://www.aps.org/careers/insight/index.cfm> (now managed by APS staff)