

Xuemei (May) Cheng, Ph.D.

(updated 09/04/2022)

Professor of Physics and Dean of Graduate Studies
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Education

Ph.D. in Physics, Johns Hopkins University
Dissertation Supervisor: Prof. ~~Chia~~ Chien
"Magnetization reversal and magnetotransport"

2006

“MRI: Acquisition of Atomic Layer Deposition Device for Nanoscale Materials Development Research

NSF DMR-1207085 (2012-2016), \$937,400 (PI)

“Collaborative Research: Hollow Nanoparticle Synthesis Templating Electrochemically Evolved Hydrogen Nanobubbles”

NSF MRI, DMR-1126656 (2011-2013), \$239,550 (PI)

“MRI: Acquisition of a UHV multi-source sputtering system for multidisciplinary material research”

NSF CAREER, DMR-1053854 (2011-2017), \$500,000

“CAREER: Magnetic bubble dynamics in nanodisks with perpendicular magnetic anisotropy”

APS Professional Skills Development Workshop Travel Grant (2009)

NSF-funded Women in Science Workshop Travel Grant (2005)

APS Opportunities in Biology Conference Travel Grant (2004)

Rowland Prize for Innovation and Excellence in Teaching (2001)

Motorola Fellowship for Excellence in Research (1999)

Guanghua Scholarship for Excellence in Research (1999, 1998)

Chien-Shiung Wu & Luke Chia-Liu Yuan Scholarship (1995)

Overview of Professional Activities

Research Accomplishments

72 publications in refereed journals, such as *Science*, *Nature Physics*, *Reports on Progress in Physics*, *Physical Review Letters*, *Nano letters*, *Advanced Materials*, *Physical Review B*, *Applied Physics Letters*. h-index 23 and citations 4161 (based on Google Scholar 20.9 (l)-42 Tc 0 Tw pDC -22.239 -1.7(4161)11 ((-ao2(a)JTJ 4 (hi)-g0 Td

Reviewer for journals: Physical Review Letters, Physical Review Applied, Applied Physics Letters, Science Reports, Journal of Applied Physics, Journal of Magnetism and Magnetic Materials, Applied Surface Science, Journal of Electroanalytical Chemistry, Journal of Physics and Chemistry of Solids
 Reviewer for general user proposals for the Center for Nanoscale Materials of Argonne National Laboratory (2016-present)
 Co-organizer for "BRYN UP", a science education program with a mission of bringing science to young people through the BRYN UP YouTube channel, as well as class visits to local middle schools (2020-)
 Organizer for an educational outreach exhibit for the Philadelphia "Science in the Park" with Bryn Mawr graduate and undergraduate students involved (Clark Park, April 2019)
 Organizer for an educational outreach exhibit booth in the Philadelphia "Science Carnival" with Bryn Mawr undergraduate students involved (Penn's Landing, April 2017)
 Invited speaker for "Physics Wonder Girls Camp" organized for Philadelphia middle school girls (2016)
 Workshop Leader for "Extend Your Horizon" and "Catalyst" for Philadelphia middle school girls (2010-13)
 Member, American Physical Society (APS), American Association of Physics Teachers (AAPT)

Teaching Experience

Bryn Mawr College
 Phys 101-2: Introductory Physics for non-majors I (Fall 2016)
 Phys 102-1 Introductory Physics II for postbaccalaureate/medical students (Spring 2014, Spring 2012)
 Phys 102-2: Introductory Physics for non-majors (Spring 2011)
 Introductory Physics Laboratory (Spring 2012, Fall 2011, Fall 2014, Spring 2015, Spring 2018, Fall 2020)
 Phys 105: Design and Making for All (Fall 2018)
 Phys 121 Lab: Modern Physics Laboratory (Fall 2016, Fall 2017, Fall 2018, Fall 2019)
 Phys 122: Introductory Classical Mechanics (Spring 2010, Spring 2019, Spring 2022)
 Phys 201: Electromagnetism (Fall 2013, Fall 2011, Fall 2010, 2009)
 Phys 201 Lab: Analog and Digital Electronics (Fall 2011)
 Phys 214 Lab: Modern Physics Laboratory (Spring 2012, Spring 2011, Spring, Spring 2015)
 Phys 306: Mathematical Methods for Physical Sciences (Fall, Fall 2014, Fall 2019, Fall 2020)
 Phys 308: Advanced Classical Mechanics I (2009)
 Phys 322/522: Solid State Physics (Fall 2013, Spring 2018)
 Phys 331 Advanced Experimental Physics (Spring 2015, Spring 2017, Spring 2019, Spring 2021)
 Phys 398/399: Physics Senior Seminar (Spring 2014, Fall 2017, Fall 2019, Fall 2020, 2021)
 Phys 403: Supervised Research (Fall 2009-Spring 2022)
 Phys 507: Graduate Statistical Mechanics (Fall 2017)
 Phys 701: Supervised Graduate Work (Fall 2019-Spring 2022)

Johns Hopkins University
 Nanostructured Magnetic Materials (Winter 2006)

Patent Applications

"Spin Memory Encryption"
 Xuemei Cheng, Kristen Buchanan, and Xiao Wang (Application #: US 17/579,048)
 "Magnetopatterned Cell-Laden Hydrogel Materials and Methods of Making and Using Same"
 Hannah M. Zlotnick, Andrew T. Clark, Robert L. Mauck, and Xuemei Cheng (Application #: US 63/009,419)

Peer-Reviewed Journal Publications

(72 published,* for correspondence author and # for Bryn Mawr student)

72. Xiao Wang[#], Alexandra R. Stuart, Mitchell S. Swyt, Carla M. Quispe Flores, Andrew T. Clark[#], Adzo

Fiagbeni[#], Rajesh V. Chopdekar, Pavel N. Lapa, Zhuyun Xiao, Dava Keavney, Richard Rosenberg, Mir Vogel, John E. Pearson, Suzanne G. E. te Velthuis, Axel Hoffmann, Kristen S. Buchanan*, and Xuemei M. Cheng*

"Topological spin memory of antiferromagnetically coupled skyrmion pairs in Co/Gd/Pt multilayers"

Phys. Rev. Materials 6, 084412 (2022). (Editor's suggestion)

<https://doi.org/10.1103/PhysRevMaterials.6.084412>

Bennett, Andy T Clark #, Xuemei Cheng Kevin T. Turner, Kiran Musunuru, and Kenneth Margulies
"Tunable and Reversible Substrate Stiffness Reveals Dynamic Mechanosensitivity of Cardiomyocytes"
ACS Appl. Mater. Interfaces, 11, 20603 (2019). <https://doi.org/10.1021/acsami.9b02446>

61. Xuanyuan Jiang, Guanhua Hao, Xiao Wang, Aaron Mosey, Xin Zhang, Le Yu, Andrew J Yost, Xin Zhang, Anthony D DiChiara, Alpha T N'Diaye, Xuemei Cheng, Jian Zhang, Ruihua Cheng, Xiaoshan Xu and Peter A Dowben
"Tunable spinstate bistability in a spin crossover molecular complex"
J. Phys. Condens. Matter, 31, 315401 (2019). <https://doi.org/10.1088/1361-648X/ab1a7d>

60. Wanjun Jiang, Sheng Zhang, Xiao Wang, Charudatta Phatak, Qiang Wang, Wei Zhang, Matthias Benjamin Jungfleisch, John E. Pearson, Yizhou Liu, Jiadong Zang, Xuemei Cheng, Amanda Petford-Long, Axel Hoffmann, and Suzanne G. E. te Velthuis
"Quantifying chiral exchange interaction for Néel-type skyrmions via Lorentz transmission electron microscopy"
Phys. Rev. B 99, 104402 (2019). <https://doi.org/10.1103/PhysRevB.99.104402>

59. Kishan Sinha, Haohan Wang, Xiao Wang, Jingying Zhou, Yuewei Yin, Wenbin Wang, Xuemei Cheng, David J. Keavney, Huibo Cao, Yaohua Liu, Xifan Wu, and Xiaoshan Xu
"Tuning the Néel Temperature of Hexagonal Ferrites by Structural Distortion"
Phys. Rev. Lett. 121, 237203 (2018). <https://doi.org/10.1103/PhysRevLett.121.237203>

58. Wanjun Jiang, Xichao Zhang, Guoqiang Yu, Wei Zhang, Xiao Wang, Matthias Jungfleisch, Xuemei Cheng, John Pearson, Olle Heinonen, Kang L. Wang, Yan Zhou, Axel Hoffmann, and Suzanne te Velthuis
"Direct Observation of the Skyrmion Hall Effect"
<https://doi.org/10.1038/nature201>

52. Li Ma, HengAn Zhou, Lei Wang, XiaLong Fan, WeiJia Fan, DeSheng Xue, Ke Xia, Zhe Wang, Ru Qian Wu, Guang-Yu Guo, Li Sun, Xiao Wang, Xue-Mei Cheng,

Functional Materials 15, 51 (2008) <http://dspace.nbuiv.gov.ua/handle/123456789/137227>

28. D. S. Gianola, B. G. Mendis, X. M. Cheng, and K. J. Hemker

"Grain-size stabilization by impurities and effect on stress-coupled grain growth in nanocrystalline Al thin films"

Mater. Sci. Eng. A 483, 637 (2008). <https://doi.org/10.1016/j.msea.2006.12.155>

27. V. Rose, X. M. Cheng, D. J. Keavney, J. W. Freeland, K. S. Buchanan, B. Ilic, and V. Metlushko

"The breakdown of the fingerprinting of vortices by hysteresis loops in circular multilayer ring arrays"

Appl. Phys. Lett. (cover) 91, 132501 (2007). <https://doi.org/10.1063/1.2786856>

26. Y. L. Iunin, Y. P. Kabanov, V. I. Nikitenko, X. M. Cheng, D. Clarke, O. A. Tretiakov, O. Tchernyshyov, A. J. Shapiro, R. D. Shull, and C. L. Chien

"Asymmetric Domain Nucleation and Unusual Magnetization Reversal in Ultra-Thin (111) Fe₃Si₂ Nanodisks"

17. "Probing Nanomagnetism using Synchrotron X-ray based Imaging"
Physics Colloquium, Saint Joseph University, September 30, 2015.
16. "Probing Nanomagnetism using Synchrotron X-ray based Imaging"
Physics Colloquium, Dickinson College, September 24, 2015.
15. "Nanomagnetic Materials: Fabrication, Characterization, and Application"
Summer school at Nanjing University Kuang Yaming Honors School, July 2014, Nanjing, China
14. "Time-resolved imaging of vortex dynamics in magnetic disks"
Physics Colloquium, Rowan University, April 25, 2014.
13. "Time-resolved PEEM imaging of Magnetic Vortex Dynamics"
Institute of Physics Chinese Academy of Sciences, August 12, 2013, Beijing, China.
12. "Imaging spin dynamics in magnetic nanostructures"
Physics Colloquium, Villanova University, November 30, 2012.
11. "Imaging spin dynamics in magnetic nanostructures"
Physics Colloquium, Nanjing Normal University, June 25, 2012, Nanjing, China.
10. "Imaging spin dynamics in magnetic nanostructures"
Physics Colloquium, Fudan University, June 21, 2012, Shanghai, China.
9. "Imaging spin dynamics in magnetic nanostructures"
Physics Colloquium, Shanghai Jiaotong University, June 19, 2012, Shanghai, China.
8. "Imaging spin dynamics in magnetic nanostructures"
Physics Colloquium, Nanjing University, June 11, 2012, Nanjing, China.
7. "Imaging spin dynamics in magnetic nanostructures"
Physics Colloquium, Central China Normal University, May 22, 2012, Wuhan, China.
6. "Imaging of spin dynamics in magnetic nanostructures"

2019 American Physical Society March Meeting, Boston, Massachusetts
50. Baiyi Kong*, Zhongying Yan, Xiao Wang, Andy Clark, Kui-Hon Ou Yang, MinnTsong Lin,
Yongseong Choi, Axel Hoffmann, Suzanne te Velthuis, Xuemei Cheng
"Room Temperature Magnetic Skyrmions in Multilayers with Interfacial Dzyaloshinskii-Moriya Interaction"
2018 American Physical Society March Meeting, Los Angeles, California

disks'

58th Annual Conference on Magnetism and Magnetic Materials (MMM) 13, Nov. 2013, Denver, CO

25. E. Moon, B. Kirby, D. Keavney, P. Balachandran, R. Siette, C. Schlepütz, E. Karapetrova, X. M. Cheng, J. Rondinelli and S. May.

"The effects of interfacial octahedral coupling on magnetic properties in ultrathin manganese films

58th Annual Conference on Magnetism and Magnetic Materials (MMM) 13, Nov. 2013, Denver, CO

24. M.A. Asmat-Uceda, X.M. Cheng, X. Wang, D.J. Keavney, D.J. Clarke, O. Tchernyshyov and K.S. Buchanan.

"Micromagnetic simulations of the dynamics of three interacting magnetic vortices in a triangular geometry

58th Annual Conference on Magnetism and Magnetic Materials (MMM) 13, Nov. 2013, Denver, CO

23. X. M. Cheng, Y. Choi, C. M. Ortega, L. Sun, Y. M. Lu, J. W. Cai and C. L. Chien

"X-ray Magnetic Circular Dichroism Study of Induced Pt Magnetic Moment in Pt/Y₃Fe₅O₁₂ Bilayers"

Gordon Research Conference on Spin Dynamics in Nanostructures, August 2013, Hong Kong.

22. Xiao Wang, D. J. Keavney, D. J. Clarke, O. Tchernyshyov, M. Asmat, K. Buchanan, A. Melikyan, and X.M. Cheng

"Time-resolved PEEM imaging of vortex dynamics in an equilateral triangular arrangement of three magnetic disks"

Gordon Research Conference on Spin Dynamics in Nanostructures, August 2013, Hong Kong.

21. Bingqing Li*, Kathryn F. Murphy, Daniel S. Gianola, and X. M. Cheng

"Study of Thermal Conductivity of Si Nanowires with micro-Raman Spectroscopy"

American Physical Society March Meeting, 2013, Baltimore, MD.

(Outstanding Undergraduate Presentation Award)

20. Xilei Kuang, Zhuyun Xiao*, Eun Ju Moon, Steven May, David Keavney, Yaohua Liu, and X.M. Cheng

"X-ray Magnetic Circular Dichroism Study of La_{1-x}Sr_xMnO₃ Thin Films"

American Physical Society March Meeting, 2013, Baltimore, MD.

19. Zhuyun Xiao*, Xiao Wang, Yaohua Liu, Suzanne G.E. te Velthuis, Daniel Rosenmann, Ralu Divan, and X. M. Cheng

"Magnetization reversal of patterned disks with perpendicular magnetic anisotropy"

American Physical Society March Meeting (poster), 2013, Baltimore, MD

18. Jiabin Liu*, Han-Chang Yang and Xuemei Cheng

"Magnetic Properties of Ordered Nanoporous Nickel Films

American Physical Society March Meeting, 2012, Boston, MA

17. Han-Chang Yang*, Stephanie I. Lim, Jiabin Liu, Qian Wu, and Xuemei Cheng

"Templated Electrodeposition of Highly Porous Nanostructured Materials "

American Physical Society March Meeting, 2011, Dallas, TX.

16. Stephanie I. Lim, Karine Namur, Florie Martineau, Jiabin Liu, Qian Wu*, Han-Chang Yang*, Jérôme Applétois

Stephanie Lim, Ph.D. (2011)

Ph. D. Dissertations Supervised

- x Andy Clark, Ph.D. (2020)
"Magnetic and mechanical properties of ultrasoft magnetorheological elastomers"
- x Xiao Wang, Ph.D. (2020)
"Magnetic skyrmions in multilayers with interfacial Dzyaloshinskii-Moriya interactions"
- x Jiajia Li, Ph.D. (2021) degree conferred by Fudan University
- x Le Yu, Ph.D. (2016) degree conferred by Nanjing University
- x Xuzhao Chai, Ph.D. (2015) degree conferred by Nanjing University

Undergraduate Theses Supervised

15. Mallory Yu (2022) "Micromagnetic simulation study of magnetic skyrmions in antiferromagnetically coupled [Co/Gd/Pt]10 multilayers"
14. Halcyon Hu (2022) "Accuracy of dipole approximation for iron particles in magnetorheological elastomers"
13. Georgia Nelson (2021) "Anomalous magnetic hysteresis loops of ultrasoft magnetorheological elastomers"
12. Tong Dong (2020) "Computational modeling of magnetorheological Elastomers"
11. Merrilyn Mercy Adzo Fiagbenu (2020) "Magnetometry characterization of [Co/Gd/Pt] multilayered thin film"
10. Zhongying Yan (2018) "Thermal Hall effect and interface magnetism of magnetic multilayers with Dzyaloshinskii-Moriya interactions"
One of the six finalists for the LeRoy Apker Award, the highest honor awarded by American Physical Society to undergraduate physicists in the United States for "outstanding achievements in physics"
9. Alena Klindziuk (2017) " Interlayer diffusion in Ta/CoFeB/MgO magnetic tunnel junctions "
8. Brittney Beidelman (2017) "Enhanced optical absorption in SiO₂/AgBr Composites "
7. Zhuyun (Maggie) Xiao (2015) " Magnetic and ferroelectric properties of epitaxial hexagonal rare earth thin films "
6. Shuoying (Elias) Yang (2014) " Temperature dependence of the Spin Hall Effect in perpendicularly magnetized magnetic materials "
5. Bingqing Li (2014) " Magnetic characterization of nickel thin dimensional antidot arrays "
4. Soraya Terrab (2013) " Development of a temperature controlled system for nanomechanical tensile testing"
3. HanChang (Cathy) Yang (December 2011) "Fabrication and magnetic characterization of nanoporous nickel structures"
2. Stonyana Alexandrova (2010) "Atomic force microscopy of DNA repeats"
1. Meghan Mahoney (2010) "Spin dynamics of magnetic nanostructures"

Undergraduate Researchers Supervised

1. Meghan Mahoney (10, 2009-2010)
2. Stonyana Alexandrova (10)