

ELISABETTA A. MATSUMOTO

CURRICULUM VITÆ

ASSISTANT PROFESSOR

School of Physics

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EDUCATION

- 2011 **Ph.D. Physics and Astronomy** University of Pennsylvania, Philadelphia, PA
2007 **M.S. Physics and Astronomy** University of Pennsylvania, Philadelphia, PA
2007 **B.A. Physics and Astronomy** *summa cum laude*, University of Pennsylvania, Philadelphia, PA

PRIOR POSITIONS

- 2014-2016 **Postdoctoral Fellow** School of Engineering and Applied Science, Harvard University, Cambridge, MA
Jan.-May 2015 **Lecturer** Applied Mathematics, School of Engineering and Applied Science, Harvard University, Cambridge, MA
2011-2014 **Postdoctoral Fellow** Princeton Center for Theoretical Science, Princeton University, Princeton, NJ
2011 **Postdoctoral Fellow** Department of Physics and Astronomy, University of Pennsylvania, Philadelphia, PA
2007-2011 **Graduate Student** Department of Physics and Astronomy, University of Pennsylvania, Philadelphia, PA
2003-2007 **Undergraduate Researcher** Department of Physics and Astronomy, University of Pennsylvania, Philadelphia, PA

CURRENT AND PAST FUNDING

- 2020-2022 **RSCA Cottrell Scholar**, “Knotty Knits: Using Topological Constraints to Program Geometry and Elastic Response in Knitted Textiles with Lattice Defects”
2019-2024 **National Science Foundation**, “CAREER: What a tangled web we weave - topology and mechanics of textiles”. *CAREER-1847172*
2018-2019 **Soft Matter Incubator Seed Grant** “Programmable elastic instabilities for on-board control of soft dextrous machines”
2017-2018 **STAMI-CRASI Seed Grant** “Building a Competitive Team: Science of Active Matter through Directional Control of Fundamental Particle Interactions”
2017-2018 **GT-FIRE Education Grant**, “Virtual Reality and Augmented Reality in STEM Education”.
2016-2017 **STAMI-SMI Seed Grant**, “Twisted Topological Tangles or: the knot theory of knitting”.

FELLOWSHIPS AND AWARDS

- 2020 **Cottrell Scholar** Class of 2020, RCSA, USA.
- 2018 **Class of 1969 Teaching Fellow**, Georgia Tech, USA.
- 2018 Nominated for the **Packard Fellowship**, David and Lucile Packard Foundation.
- 2018 Nominated for the **Soft Matter Lectureship**, *Soft Matter*, London, UK.
- 2016 **Stjepan Marcelja Fellow**, The Australian National University, Canberra, ACT, Australia.
- 2012 **Glenn Brown Dissertation Prize** *For highly creative application of analytical mathematics combined with deep geometric insight to an especially interesting variety of problems in liquid crystal physics.*
International Liquid Crystal Society.
- 2010 **Elias Burstein Prize** *Awarded to the graduate student in Condensed Matter Physics judged to have made a significant contribution to the understanding of the subject.*
Department of Physics and Astronomy, University of Pennsylvania.
- 2010 **American Physical Society GSNP Student Speaker Award Winner.**
Group on Statistical and Nonlinear Physics, American Physical Society.
- 2007 **William E. Stephens Memorial Prize** *Awarded to the graduating physics major judged to have demonstrated the most promise for a successful career as a scientist based on overall performance in the undergraduate program.*
Department of Physics and Astronomy, University of Pennsylvania.
- 2007 **Elected to Phi Beta Kappa National Honor Society**
- 2006 **Roy and Diana Vagelos Science Challenge Award** *To reward the very best, motivated and advanced science students, and challenge them to get the most from themselves and Penn.*
Department of Physics and Astronomy, University of Pennsylvania.

REFEREED OUTPUTS

- Shashank G. Markande and Elisabetta A. Matsumoto “Knotty knits are tangles on tori”, *Proceedings of Bridges 2020: Mathematics, Music, Art, Architecture, Culture in press* (2020).
- Rémi Coulon, Elisabetta A. Matsumoto, Henry Segerman, Steve Trettel “Non-Euclidean Virtual Reality IV: Sol”, *Proceedings of Bridges 2020: Mathematics, Music, Art, Architecture, Culture in press* (2020).
- Rémi Coulon, Elisabetta A. Matsumoto, Henry Segerman, Steve Trettel “Non-Euclidean Virtual Reality III: Nil”, *Proceedings of Bridges 2020: Mathematics, Music, Art, Architecture, Culture in press* (2020).
- Elisabetta A. Matsumoto and Henry Segerman “Geared Jitterbugs”, *Proceedings of Bridges 2019: Mathematics, Music, Art, Architecture, Culture* 399-402, (2019).
- James McInerney, Perry W. Ellis, D. Zeb Rocklin, Alberto Fernandez-Nieves and Elisabetta A. Matsumoto “Curved boundaries and chiral instabilities two sources of twist in homeotropic nematic tori”, *Soft Matter* **15**, 1210-1214 (2019).
- Shashank Markande, Gerd E. Schröder-Turk and Elisabetta A. Matsumoto, “The QTZ-QZD Surface: A family of chiral triply periodic minimal surfaces”, *Proceedings of the Royal Society A. (under review)* (2018).
- Perry W. Ellis, Karthik Nayani, James P. McInerney, D. Zeb Rocklin, Jung Ok Park, Mohan Srinivasarao, Elisabetta A. Matsumoto, Alberto Fernandez-Nieves, “Curvature-induced twist in homeotropic nematic tori”, *Phys. Rev. Lett*, **121**, 247803 (2018).
- Wim van Rees, Elisabetta A. Matsumoto, A. Sydney Gladman, Jennifer A. Lewis and L. Mahadevan, “Simulating the shape change of thin structures”, *Soft Matter*, **14**, 8771 (2018).
- Alireza Dastan, Elisabetta A. Matsumoto, William J. Frith and Douglas J. Cleaver, “Assembly Mechanisms for Twisted, Multi-Sheet Bundles”, *Molecular Physics*, **116** 2823-2835, (2018).

- Elisabetta A. Matsumoto, Henry Segerman and Fabienne Serriere, “Möbius cellular automata scarves”, *Proceedings of Bridges 2018: Mathematics, Music, Art, Architecture, Culture* 523-526, (2018).
- Elisabetta A. Matsumoto, Haiyi Liang and L. Mahadevan, “Topology, Geometry and Mechanics of Z-plasty”, *Phys. Rev. Lett.* **120**, 068101 (2018).
- Elisabetta A. Matsumoto, “A Klein Quartic Quilt”, *Proceedings of Bridges 2017: Mathematics, Music, Art, Architecture, Culture*, 411-414 (2017).
- Vi Hart, Andrea Hawksley, Elisabetta A. Matsumoto* and Henry Segerman*, “Non-euclidean virtual reality I: explorations of \mathbb{H}^3 ”, *Proceedings of Bridges 2017: Mathematics, Music, Art, Architecture, Culture* 32-40 (2017).
(* These authors contributed equally.)
- Vi Hart, Andrea Hawksley, Elisabetta A. Matsumoto* and Henry Segerman*, “Non-euclidean virtual reality II: explorations of $\mathbb{H}^2 \times \mathbb{E}$ ”, *Proceedings of Bridges 2017: Mathematics, Music, Art, Architecture, Culture* 41-48 (2017).
(* These authors contributed equally.)
- Elisabetta A. Matsumoto, Randall D. Kamien and Gareth P. Alexander, “Straight Round the Twist: Frustration and Chirality in Smectics-A”, *J. Interface Focus* **7**(4) 20160118 (2017).
- A. Sydney Gladman*, Elisabetta A. Matsumoto*, Ralph G. Nuzzo, L. Mahadevan and Jennifer A. Lewis, “Biomimetic 4D Printing,” *Nat. Mater.* **15** 413-418 (2016).
(* These authors contributed equally.)
- Jennifer A. Lewis, A. Sydney Gladman, Elisabetta A. Matsumoto and L. Mahadevan, “Hydrogel composite ink formulation and method of 4D printing a hydrogel composite structure,” United States Patent Application, 30 November 2015.
- Elisabetta A. Matsumoto, Daniel A. Vega, Aldo D. Pezzutti, Nicolás A. García, Paul M. Chaikin and Richard A. Register, “Wrinkles and Splay Conspire to Give Positive Disclinations Negative Curvature,” *Proc. Nat. Acad. Sci.* **112** 12639-12644 (2015).
- S. Yang, Y. Zhang, R. D. Kamien, J. M. Kikkawa, E. A. Matsumoto and D. Chandra, “Patterning Structures Using Deformable Substrates,” U.S. Patent 8,557,341 B2, filed 23 April 2008, and issued 15 October 2013.
- Elisabetta A. Matsumoto, “Patterns on a Roll”, in: *Experience-centered Approach and Visuality in the Education of Mathematics and Physics*, edited by J. Barrallo, M. Budin, A. Durity, K. Fenyvesi, S. Jablan, A. Takács, Lj. Radović, R. Sazdanović and E. Stettner, Kaposvár, Hungary: Kaposvár University, 2012, p.175-176.
- Elisabetta A. Matsumoto and Randall D. Kamien, “Patterns on a Roll: A Method for Continuous Feed Nanoprinting,” *Soft Matter* **8** 11038 (2012).
- Elisabetta A. Matsumoto, Christian D. Santangelo and Randall D. Kamien, “Smectic Pores and Defect Cores,” *J. Interface Focus* **2** 617 (2012).
- Gareth P. Alexander, Bryan G. Chen, Elisabetta A. Matsumoto and Randall D. Kamien, “Colloquium: Disclination loops, hedgehogs, and all that in nematic liquid crystals,” *Rev. Mod. Phys.* **84** 497 (2012).
- Gareth P. Alexander, Bryan G. Chen, Elisabetta A. Matsumoto and Randall D. Kamien, “The Power of the Poincaré Group: Elucidating the Hidden Symmetries in Focal Conic Domains” *Phys. Rev. Lett.* **104** 257802 (2010).

Elisabetta A. Matsumoto, Gareth P. Alexander and Randall D. Kamien, “Helical Nanofilaments and the High Chirality Limit of Smectics-A,” *Phys. Rev. Lett.* **103** 257804 (2010).

Elisabetta A. Matsumoto and Randall D. Kamien “Elastic-instability Triggered Pattern Formation,” *Phys. Rev. E* **80** 021604 (2009). *Also appears in the Virtual Journal of Nanoscale Science and Technology.*

Ying Zhang, Elisabetta A. Matsumoto, Anna Peter, Pei-Chun Lin, Randall D. Kamien and Shu Yang, “One-step Nanoscale Assembly of Complex Structures via Harnessing of an Elastic Instability,” *Nano Letters* **8** 1192 (2008).

DISSERTATION

Elisabetta A. Matsumoto, “The Taming of the Screw or: How I Learned to Stop Worrying and Love Elliptic Functions,” Department of Physics and Astronomy, University of Pennsylvania (2011).

INVITED PRESENTATIONS

“A tale of two chiralities”, Numerical Methods and New Perspectives for Extended Liquid Crystalline Systems, ICERM, Providence, Rhode Island, USA, 2019.

“Programmable Matter- 3D printing a metric to direct shape transformation”, Illustrating Dynamics and Probability, ICERM, Providence, Rhode Island, USA, 2019.

“Hyperbolic Quilting Workshop”, Computational Textiles Working Group, ICERM, Providence, Rhode Island, USA, 2019.

“Twisted topological tangles: or the knot theory of knitting”, Computational Textiles Working Group, ICERM, Providence, Rhode Island, USA, 2019.

“Non-euclidean virtual reality”, Illustrating Geometry and Topology, ICERM, Providence, Rhode Island, USA, September 2019. (Keynote/plenary speaker)

“Twisted topological tangles: or the knot theory of knitting”, Soft Matter Physics Gordon Conference, New London, New Hampshire, USA, August 2019.

“Non-euclidean virtual reality”, Southeastern Undergraduate Math Workshop, Atlanta, Georgia, USA, August 2019.

“Twisted topological tangles”, Bridges 2019: Mathematics, Art, Music, Architecture, Education, Culture, Linz, Austria, July 2019. (Keynote/plenary speaker)

“Geared jitterbugs,” Bridges 2019: Mathematics, Art, Music, Architecture, Education, Culture, Linz, Austria July 2019.

“Non-euclidean virtual reality”, Park City Math Institute, Park City, Utah, USA, June 2019. (Keynote/plenary speaker)

“Non-euclidean virtual reality”, International Virtual Reality Professionals Association conference 2019, Belfast, Northern Ireland, June 2019.

“Twisted topological tangles: or the knot theory of knitting”, MERI Symposium 2019, Materials and Engineering Research Institute, Sheffield Hallam, Sheffield, UK, May 2019. (Keynote/plenary speaker)

“Twisted topological tangles: or the knot theory of knitting”, Optimal design of soft matter, Newton Institute, Cambridge, UK, May 2019.

“Twisted topological tangles: or the knot theory of knitting”, American Physical Society March Meeting, Boston, Massachusetts, USA, March 2019.

“Non-euclidean virtual reality” CUWiP South Eastern Conference, University of Alabama, Tuscaloosa, Alabama, USA, January 2019.

“Using Mathematica for 3D printing” Construct3D, Georgia Institute of Technology, Atlanta, GA, USA, October 2018.

“Design of hinged 3D auxetic mechanisms” - Hot Topics: Shape and Structure of Materials, Mathematical Sciences Research Institute, Berkeley, CA, USA, October 2018.

“4D Printing” - 3rd Edwards Symposium, Turing Gateway to Mathematics, University of Cambridge, Cambridge, UK, September 2018.

“Non-euclidean virtual reality” Pixar, Emoryville, California, USA, August 2018.

“Non-euclidean virtual reality” SUMaC – Stanford Undergrad Math Camp, Stanford University, Palo Alto, California, USA, August 2018.

“Conformal Transformations of Spherical Video for Social VR applications” TNO industry/collaboration talk, TNO, The Hague, The Netherlands, August 2018.

“Möbius Cellular Automata Scarves” Bridges 2018: Mathematics, Art, Music, Architecture, Education, Culture, Stockholm, Sweden, July 2018.

“Programmable matter: shape shifting 3D printed printed polymer gels”, Functional Microgels and Microgel Systems, Monschau, Germany, July 2018.

“Why be straight: or the undeniable pervasiveness of twisting” Geometry of Soft Matter, International Institute of Physics, Natal, Brazil, May 2018.

“Non-euclidean virtual reality” Gathering for Gardner, Atlanta, Georgia, USA, April 2018.

“Hinged 3D Auxetic Mechanisms” Gathering for Gardner, Atlanta, Georgia, USA, April 2018.

“Programmable Matter: 3D printed elastomers with nematic order,” Liquid Crystals, Metamaterials, Transformation Optics, Photonic Crystals, and Solar Cells, Institute for Mathematics and its Applications, University of Minnesota, Minneapolis, Minnesota, USA February 2018.

“Why Be Straight?: Or the undeniable pervasiveness of twisting,” Geometrically Frustrated Self-Assembly, Princeton, New Jersey, USA, November 2017.

“Non-euclidean virtual reality,” Two Sigma Investments, New York City, New York, USA, October 2017.

“Non-euclidean virtual reality,” (keynote lecture) Geometry Labs United 2017 Conference, Seattle, Washington, USA, August 2017.

“Non-euclidean virtual reality,” Southeastern Undergraduate Mathematics Conference, Atlanta, Georgia, USA, August 2017.

“Design of Hinged 3D Auxetic Mecanisms,” SIAM Conference on Algebraic Geometry, Atlanta, Georgia, USA, August 2017.

“Quilting the Klein Quartic,” Bridges 2017: Mathematics, Art, Music, Architecture, Education, Culture, Waterloo, Ontario, Canada July 2017.

“Non-euclidean virtual reality,” Bridges 2017: Mathematics, Art, Music, Architecture, Education, Culture, Waterloo, Ontario, Canada July 2017.

“Non-euclidean virtual reality,” Symposium on Computational Geometry, Brisbane, Australia, July 2017.

“Programmable Matter: using 3D printed elastic instabilities to direct shape transformation,” Workshop on 3D Printing, University of Durham, Durham, UK, June, 2017.

“Elastic instabilities, pattern formation and programmable matter,” Newton, Goethe, D’Arcy Thompson and self-organised complexity of shape: A symposium, Canberra, Australia, April 2016.

“Phytomimetic 4D Printing,” (keynote lecture) Shape-up: Exercise in Materials Geometry and Topology, Berlin, Germany, September 2015.

“Dr. Wrinkle and Mr. Hyde, the ins and outs of pattern formation in elastic films,” ICERM Workshop Small Clusters, Polymer Vesicles and Unusual Minima, Providence, Rhode Island, USA, March 2015.

“Disclination Induced Wrinkles in Free Standing Smectic Membranes,” SIAM Conference on Mathematical Aspects of Materials Science, Philadelphia, Pennsylvania, USA, June 2013.

“The Taming of the Screw: Riemann’s Minimal Surface and Sums of Helicoids,” MRS Fall Meeting, Boston, Massachusetts, USA, November 2012.

“The Taming of the Screw: Helicoids and Frustration in Equally Spaced Smectics,” International Liquid Crystal Conference, Mainz, Germany, August 2012.

“The Taming of the Screw: Riemann’s Minimal Surface and Sums of Helicoids,” Geometry of Interfaces, Primosten, Croatia, October 2011.

“Controlling Elastic Instabilities: From Complex Pattern Formation to Functionality,” Princeton/Penn/NYU Soft Matter Workshop, Princeton University, Princeton, New Jersey, USA, December 2010.

“Controlling Elastic Instabilities: From Complex Pattern Formation to Functionality,” APS March Meeting, Portland, Oregon, USA, March 2010.

“Smectic Defects with Riemann Reason,” Curvature and Variational Modeling in Physics and Biophysics, Santiago de Compostella, Spain, September 2007.

SEMINARS AND COLLOQUIA

“Non-euclidean virtual reality” Soft Matter Seminar, Syracuse University, Physics Department, Syracuse, New York, USA, January 2020.

“Twisted topological tangles: or the knot theory of knitting”, Physics Colloquium, Physics Department, Syracuse University, Syracuse, New York, USA, January 2020.

“Twisted topological tangles: or the knot theory of knitting”, Applied Mathematics Colloquium, UMass Boston, Boston, Massachusetts, USA, November 2019.

“Twisted topological tangles: or the knot theory of knitting”, Applied Mathematics Colloquium, MIT, Cambridge, Massachusetts, USA, October 2019.

“Non-euclidean virtual reality” NC State VR Library Public Lecture, North Carolina State University, Raleigh, North Carolina, USA, USA, October 2019.

“Twisted topological tangles: or the knot theory of knitting”, Physics Colloquium, North Carolina State University, Raleigh, North Carolina, USA, October 2019.

“Non-euclidean virtual reality” Department Mathematics Math Club, University of North Carolina at Chapel Hill at Chapel Hill, North Carolina, USA, October 2019.

“Twisted topological tangles: or the knot theory of knitting”, Applied Mathematics Colloquium, University of North Carolina at Chapel Hill, Chapel Hill, North Carolina, USA, October 2019.

“Twisted topological tangles: or the knot theory of knitting”, Mathematics Colloquium, Wellesley College, Wellesley, Massachusetts, USA, October 2019.

“Programmable Matter: using 3D printed elastic anisotropies to direct shape transformation,” Chemistry Seminar, University of Bath, Bath, UK, May 2019.

“Twisted topological tangles: or the knot theory of knitting”, Physics Colloquium, Department of Physics, University of Bristol, Bristol, UK, May 2019.

“Twisted topological tangles: or the knot theory of knitting”, ABC Physics seminar, University of Washington, Seattle, Washington, USA, May 2019.

“Non-euclidean virtual reality” Department of Physics Colloquium, Agnes Scott College, Decatur, Georgia, USA, April 2019.

“Non-euclidean virtual reality” Department of Physics Colloquium, Tufts University, Medford, Massachusetts, USA, Dec 2018.

“Non-euclidean virtual reality” Department of Mathematics Seminar, University of Sydney, Sydney, Australia, June 2018.

“Non-euclidean virtual reality” Department of Applied Mathematics Colloquium, The Australian National University, Canberra, Australia, June 2018.

“Non-euclidean virtual reality” Department of Physics and Astronomy Colloquium, Northwestern University, Evanston, Illinois, USA, May 2017.

“Non-euclidean virtual reality,” National Museum of Mathematics, Public Lecture, New York City, New York, December 2017.

“Non-euclidean virtual reality,” University of Pennsylvania, Philadelphia, Pennsylvania, November 2017.

“Non-euclidean virtual reality,” Oklahoma State University, Public Lecture, Stillwater, Oklahoma, October 2017.

“Programmable Matter: using 3D printed elastic anisotropies to direct shape transformation,” Oklahoma State University, Mathematics Colloquium, October 2017.

“Design of hinged 3D auxetic mechanisms,” Mount Holyoke, Physics Student Seminar, South Hadley, Massachusetts, October 2017.

“Non-euclidean virtual reality,” University of Massachusetts Amherst, Special Seminar, Amherst, Massachusetts, October 2017.

“Design of hinged 3D auxetic mechanisms,” University of Massachusetts Amherst, Condensed Matter Physics Seminar, Amherst, Massachusetts, October 2017.

“Programmable Matter: using 3D printed elastic anisotropies to direct shape transformation,” Brown University, Fluids Seminar, Providence, Rhode Island, October 2017.

“Programmable Matter: using 3D printed elastic instabilities to direct shape transformation,” University of Pennsylvania, Applied Topology Seminar, Philadelphia, Pennsylvania, September 2017.

“Programmable Matter: using 3D printed elastic instabilities to direct shape transformation,” University of Pennsylvania, Applied Topology Seminar, Philadelphia, Pennsylvania, September 2017.

“Programmable Matter: using 3D printed elastic instabilities to direct shape transformation,” University of Western Australia, School of Physics Colloquium, Perth, Australia, July 2017.

“Warped spaces: a virtual reality journey,” Australian Institute of Physics, Public Lecture, Murdoch University, Perth, Australia, July 2017.

“Non-euclidean virtual reality,” Geometry and Topology Seminar/Theoretical Physics Seminar, University of Warwick, Coventry, UK, May 2017.

“Non-euclidean virtual reality,” Public Lecture, School of Physics, University of Bristol, Bristol, UK, May 2017.

“Non-euclidean virtual reality,” School of Simulation and Visualisation, The Glasgow School of Art, Glasgow, UK, May 2017.

“Programmable Matter: using 3D printed elastic instabilities to direct shape transformation,” Department of Applied Physics, University of North Carolina, Chapel Hill, April 2017.

“Non-euclidean virtual reality,” School of Mathematics, Georgia Institute of Technology, Atlanta, Georgia April, 2017.

“Programmable Matter: using 3D printed elastic instabilities to direct shape transformation,” Department of Physics, University of Michigan, Ann Arbor, Michigan, February 2017.

“Programmable Matter: using 3D printed elastic instabilities to direct shape transformation,” Department of Physics, Emory University, Atlanta, Georgia, February 2017.

“Phytomimetic 4D Printing,” School of Mathematics, Murdoch University, Perth, Australia, April 2016.

“Biomimetic 4D Printing,” Department of Mechanical Engineering, Johns Hopkins University, Baltimore, Maryland, USA, March 2016.

“Biomimetic 4D Printing,” School of Mathematics and Physics, University of Queensland, Brisbane, Australia, February 2016.

“Elastic anisotropies and the rational design of programmable matter,” Department of Applied Mathematics and Theoretical Physics, University of Cambridge, Cambridge, UK, February 2016.

“Biomimetic 4D Printing,” Department of Mathematics, Duke University, Durham, North Carolina, USA, February 2016.

“Biomimetic 4D Printing,” School of Engineering, École Polytechnique Fédérale de Lausanne, Lausanne, Switzerland, February 2016.

“Biomimetic 4D Printing,” School of Physics, Georgia Institute of Technology, Atlanta, Georgia, USA, January 2016.

“Biomimetic 4D Printing,” Kavli Institute for Theoretical Physics, University of California at Santa Barbara, Goleta, California, USA, January 2016.

“Biomimetic 4D Printing,” Engineering Sciences and Applied Mathematics Colloquium, Northwestern University, Evanston, Illinois, USA, January 2016.

“Pattern Formation in Thin Elastic Films,” Soft Matter Seminar, Tufts University, Medford, Massachusetts, USA, February 2015.

“Pattern Formation in Thin Elastic Films,” Soft Matter Seminar, Georgetown University, Washington D.C., USA, May 2014.

“A Tale of Two Smectics: exploring the coupling between topological defects and curvature in ordered materials,” Condensed Matter Seminar, Johns Hopkins University, Baltimore, Maryland, USA, March 2014.

“A Tale of Two Smectics: exploring the coupling between topological defects and curvature in ordered materials,” PACM Seminar, Princeton University, Princeton, New Jersey, USA, February 2014.

“Pattern Formation in Thin Elastic Films,” Soft Matter Seminar, University of California, San Diego, San Diego California, USA, January 2014.

“How to Crochet Hyperbolic Planes and Tilings,” Knotted Fields program, Kavli Institute for Theoretical Physics, Santa Barbara, California, USA, July 2012.

“The Taming of the Screw: Riemann’s Minimal Surface and Sums of Helicoids,” Workshop on Topology: Identifying Order in Complex Systems, Rutgers University, New Brunswick, New Jersey, USA, February 2012.

“Defects in Smectics A: From the Helical Nanofilament Phase to Focal Conic Domains,” WAM Seminar, Harvard University, Cambridge, Massachusetts, USA, January 2011.

“Defects in Smectics A: From Focal Conic Domains to the Helical Nanofilament Phase,” Brandeis University, Waltham, Massachusetts, USA, November 2010.

“Controlling Elastic Instabilities: From Complex Pattern Formation to Functionality,” Brown University, Providence, Rhode Island, USA, October 2010.

CONTRIBUTED CONFERENCE PRESENTATIONS

V. Hart, A. Hawksley, E. A. Matsumoto and H. Segerman, “Non-euclidean virtual reality”, Soft Matter Gordon Conference, New London, New Hampshire, USA, August 2017. (poster)

E. A. Matsumoto and H. Segerman, “Design of Hinged 3D Auxetic Mechanisms”, Soft Matter Gordon Conference, New London, New Hampshire, USA, August 2017. (demonstration)

A. Dastan, W. J. Frith, E. A. Matsumoto* and D. J. Cleaver, “Why Be Straight? Or: the undeniable pervasiveness of twisting,” Bowden Research Convergence, Animal, Vegetal Mineral, Yallingup, Australia, September 2016. (Talk)

E. A. Matsumoto, A. Sydney Gladman, Jennifer. A. Lewis and L. Mahadevan, “4D Printing Elastomers with Nematic Order,” International Liquid Crystal Conference, Kent State University, Kent, Ohio, USA, August 2016. (Talk)

E. A. Matsumoto, A. Sydney Gladman, Jennifer. A. Lewis and L. Mahadevan, “Anisotropy Controlled Programmable Architectures in 4D Printing,” Materials Research Society Fall Meeting, Boston, Massachusetts, USA, November 2015. (Talk)

- E. A. Matsumoto, L. Mahadevan, and Jennifer A. Lewis, "Phytomimetic 4D Printing," Gordon Research Conference on Soft Condensed Matter Physics, New London, New Hampshire, USA, August 2015. (Poster)
- A. Sydney Gladman, E. A. Matsumoto, L. Mahadevan, and Jennifer A. Lewis, "Phytomimetic 4D Printing," Gordon Research Conference on Soft Condensed Matter Physics, New London, New Hampshire, USA, August 2015. (Poster)
- E. A. Matsumoto, "I'm Fixing a Hole," Geometry and topology of liquid crystals and related ordered materials, Niels Bohr Institute, University of Copenhagen, Copenhagen, Denmark, August 2013. (Talk)
- E. A. Matsumoto, R. D. Kamien, and G. P. Alexander, "Straight Round the Twist: Frustration and Chirality in Equally Spaced Smectics," Newton Institute Programme on the Mathematics of Liquid Crystals, Liquid Crystal Defects and their Geometry, Active and Soft Solid Liquid Crystals, and Related Systems, Cambridge, UK, June 2013. (Poster)
- E. A. Matsumoto, R. D. Kamien, and G. P. Alexander, "Straight Round the Twist: Frustration and Chirality in Equally Spaced Smectics," Gordon Research Conference on Liquid Crystals, Biddeford, Maine, USA, June 2013. (Poster)
- E. A. Matsumoto, G. P. Alexander, B. G. Chen, and R. D. Kamien, "The Power of Poincaré: Elucidating Hidden Symmetries in Focal Conic Domains," Gordon Research Conference on Liquid Crystals, South Hadley, Massachusetts, USA, June 2011. (Poster)
- E. A. Matsumoto, G. P. Alexander, B. G. Chen, and R. D. Kamien, "Shedding Light on Focal Conic Domains," APS March Meeting, Dallas, Texas, USA, March 2011. (Talk)
- E. A. Matsumoto, G. P. Alexander, and R. D. Kamien, "Helical Nanofilaments and the High Chirality Limit of Smectics A," 23rd International Liquid Crystal Conference, Krakow, Poland, July 2010. (Talk)
- E. A. Matsumoto, Y. Zhang, X. Zhu, R. Dong, A. Peter, P.-C. Lin, R. D. Kamien, J. M. Kikkawa, and S. Yang. "IRG2: Functional Cylindrical Assemblies: Harnessing Elastic Instability for Functional Nanostructures," NSF MRSEC Review, November 2009. (Poster)
- E. A. Matsumoto, G. P. Alexander, and R. D. Kamien, "The Taming of the Screw: A Short Story" Gordon Research Conference on Liquid Crystals, New London, New Hampshire, USA, June 2009. (Poster)
- E. A. Matsumoto, G. P. Alexander, and R. D. Kamien, "The Taming of the Screw," Soft Solids and Complex Fluids Summer School, University of Massachusetts Amherst, Amherst, Massachusetts, USA, May 2009. (Poster)
- E. A. Matsumoto, G. P. Alexander, and R. D. Kamien, "The Taming of the Screw," Hougen Symposium on Frontiers of Liquid Crystals, University of Wisconsin Madison, Madison, Wisconsin, USA, April 2009. (Poster)
- E. A. Matsumoto, G. P. Alexander, and R. D. Kamien, "The Taming of the Screw," APS March Meeting, Pittsburgh, Pennsylvania, USA, March 2009. (Talk)
- E. A. Matsumoto and R. D. Kamien, "Harnessing Elastic Instability: The Self-Assembly of Complex Patterns," APS March Meeting, New Orleans, Louisiana, USA, March 2008. (Talk)
- E. A. Matsumoto, C. D. Santangelo, and R. D. Kamien, "Smectic Defects with Riemann Reason," Gordon Research Conference on Liquid Crystals, New London, New Hampshire, USA, June 2007. (Poster)
- E. A. Matsumoto, C. D. Santangelo, and R. D. Kamien, "Smectic Defects with Riemann Reason," APS March Meeting, Denver, Colorado, USA 2007. (Talk)

STUDENT PRESENTATIONS

- M. Dimitriyev*, K. Singal and E. A. Matsumoto, “Forming fabric from knitted curves”, Computational Textiles Working Group, ICERM, Providence, Rhode Island, USA, September 2019. (Invited Talk)
- K. Singal*, M. Dimitriyev and E. A. Matsumoto, “Strain-Strain Studies of Knitted Swatches”, Computational Textiles Working Group, ICERM, Providence, Rhode Island, USA, September 2019. (Poster)
- S. Markande* and E. A. Matsumoto, “A study of knit links: links derived from the stitch patterns of knitted fabrics”, Computational Textiles Working Group, ICERM, Providence, Rhode Island, USA, September 2019. (Poster)
- B. Day* and E. A. Matsumoto, “Hyperbolic space in VR”, Illustrating Geometry and Topology, ICERM, Providence, Rhode Island, USA, September 2019. (Poster)
- K. Singal*, M. Dimitriyev and E. A. Matsumoto, “Strain-Strain Studies of Knitted Swatches”, Illustrating Geometry and Topology, ICERM, Providence, Rhode Island, USA, September 2019. (Poster)
- M. Dimitriyev*, K. Singal and E. A. Matsumoto, “A general geometric framework for knitted fabric elasticity”, Soft Matter Physics Gordon Conference, New London, New Hampshire, USA August 2019. (Poster)
- J. McInerney*, P. Ellis, A. Fernandez-Nieves, D. Rocklin and E. A. Matsumoto, “Inducing chirality in homeotropic nematics via confinement geometry”, Liquid Crystal Gordon Conference, New London, New Hampshire, USA July 2019. (Poster)
- J. McInerney*, P. Ellis, A. Fernandez-Nieves, D. Rocklin and E. A. Matsumoto, “Inducing chirality in homeotropic nematics via confinement geometry”, APS March Meeting, Boston, Massachusetts, USA March 2019. (Talk)
- S. Markande* and E. A. Matsumoto, “A topological perspective on knitted fabrics”, APS March Meeting, Boston, Massachusetts, USA March 2019. (Talk)
- M. Dimitriyev*, K. Singal and E. A. Matsumoto, “A general geometric framework for knitted fabric elasticity”, APS March Meeting, Boston, Massachusetts, USA, March 2019 (Talk)
- M. Dimitriyev* and E. A. Matsumoto, “Geometry and mechanics of knitted fabric”, Soft Matter Frontiers, Georgia Institute of Technology, Atlanta, Georgia, USA, April 2018 (Talk)
- S. Markande* and E. A. Matsumoto, “The QTZ-QZD Surface: A Family of Chiral Triply Periodic Minimal Surfaces”, Joint SIAM Student Conference, Georgia Institute of Technology, Atlanta, Georgia, USA, April 2018. (Talk)
- M. Dimitriyev* and E. A. Matsumoto, “Geometry and mechanics of knitted fabrics: or form and function in fabric”, APS March Meeting, Los Angeles, California, USA, March 2018 (Talk)
- S. Markande, G. E. Schröder-Turk and E. A. Matsumoto, “The QTZ-QZD Surface: A Family of Chiral Triply Periodic Minimal Surfaces,” Liquid Crystals, Metamaterials, Transformation Optics, Photonic Crystals, and Solar Cells, Institute for Mathematics and its Applications, University of Minnesota, Minneapolis, Minnesota, USA, February 2018. (Poster)

SELECT PROFESSIONAL ACTIVITIES

DSOFT Executive Committee Member-at-large, American Physical Society. (2018-2021).

Panelist 2019 Soft Matter Physics Gordon Symposium, August 2019.

3D Printing for Mathematics and Virtual Reality Demos, Park City Mathematics Institute, Park City, Utah, USA, Summer 2019.

Head Curator, Mathapalooza! Art Exhibition, Julia Robinson Math Festival, Decatur, Georgia, March 2019.

3D Printing for Mathematics and Virtual Reality Demos, Park City Mathematics Institute, Park City, Utah, USA, Summer 2017.

Packing of Continua, Aspen Center for Physics, Aspen, Colorado, USA, Summer 2017.

Geometry, elasticity, fluctuations, and order in 2D soft matter, KITP Program, Kavli Institute for Theoretical Physics, University of Santa Barbara, Santa Barbara, California, USA, Spring 2016.

Geometry, Symmetry and Topology of Liquid Crystals and Framework Materials, Royal Melbourne Institute for Technology, Melbourne, Victoria, Australia, August 2014.

Geometry and topology of liquid crystals and related ordered materials, Niels Bohr Institute International PhD School, University of Copenhagen, Copenhagen, Denmark, August 2013.

Knotted Fields, KITP Program, Kavli Institute for Theoretical Physics, University of Santa Barbara, Santa Barbara, California, USA, June/July 2012.

Soft Solids and Complex Fluids, Summer School, University of Massachusetts Amherst, Amherst, Massachusetts, USA, May 2009.

Soft Solids and Complex Fluids, Summer School, University of Massachusetts Amherst, Amherst, Massachusetts, USA, June 2008.

Curvature and Variational Modeling in Physics and Biophysics, Summer School, Santiago de Compostella, Spain, September 2007.

Undergraduate Researcher, CERN, Geneva, Switzerland, Summer 2004.

CONFERENCES AND WORKSHOPS ORGANIZED

Organizer Computational Textiles Working Group, ICERM, September 2019.

Organizer PowerHour at the 2019 Soft Matter Physics Gordon Conference, August 2019.

Organizer Geometry in Soft Matter, International Institute of Physics, Natal, Brazil, May 2018.

Organizer Soft Matter Forefronts, Atlanta, GA, USA, April 2018.

Organizer Function from Geometry: 3D Printing to Programmable Matter, American Physical Society March Meeting, New Orleans, LA, USA, March 2017.

Organizer Through the Looking-glass: A Glimpse into the Geometry and Topology of Materials, Princeton Center for Theoretical Science, Princeton, NJ, USA, December 2012.

Co-organizer Workshop on Topology: Identifying Order in Complex Systems, Princeton Center for Theoretical Science, Princeton, NJ, USA, December 2011.

Co-organizer Towards Unifying Concepts in the Physics of Aperiodic Systems, Princeton Center for Theoretical Science, Princeton, NJ, USA, October 2011.

TEACHING

Spring 2020	Physics 3202	<i>Classical Mechanics II</i>
Spring 2019	Physics 3202	<i>Classical Mechanics II</i>
Fall 2018	Physics 8823	<i>Geometry and 3D Printing</i>
Spring 2018	Physics 2211	<i>Introductory Physics I: Mechanics</i>
Spring 2017	Physics 2211	<i>Introductory Physics I: Mechanics</i>
Fall 2016	Physics 2211	<i>Introductory Physics I: Mechanics</i>
Spring 2015	Applied Mathematics 105	<i>Ordinary and Partial Differential Equations</i> (Harvard University).

OUTREACH

- May 2019 “Knitty Knots: an evening of maths and crafts” public lecture with SciXSW and e-Stitches Bristol, The Watershed, Bristol, UK.
- March 2019 Curated the art gallery for “Mathapalloza” a Julia Robins Math Festival part of Atlanta Science Festival in Atlanta, Georgia, USA.
- March 2018 “Mathematics in Motion” Virtual reality demonstration at the Atlanta Science Festival in Atlanta, Georgia, USA.
- December 2017 “Non-euclidean virtual reality” Virtual reality demonstration at the National Museum of Mathematics in New York City, New York, USA.
- August 2017 “Bending the rules of geometry” New York Times Daily 360 video. With M Eifler, Vi Hart, Andrea Hawksley and Henry Segerman. [https : //www.nytimes.com/video/science/100000005297565/bending – rules – hyperbolic – geometry – vi – hart.html](https://www.nytimes.com/video/science/100000005297565/bending%20rules%20hyperbolic%20geometry%20vi%20hart.html)
- August 2017 “Exploring Hyperbolic Space with VR (and crochet)” Standupmaths video with Matt Parker and Henry Segerman. [https : //www.youtube.com/watch?v = MTFviv_aZYI](https://www.youtube.com/watch?v=MTfviv_aZYI)
- April 2017 College of Science Research Presentation “Non-euclidean virtual reality”.
- March 2017 “ Non-euclidean virtual reality” YouTube video with Henry Segerman. [https : //www.youtube.com/watch?v = ztsi0CLxmjw](https://www.youtube.com/watch?v=ztsi0CLxmjw)
- March 2017 TEDx Douglasville “A Journey through non-euclidean geometry”.
- February 2017 Oglethorpe University “*Purls* of wisdom: Geometry & Topology of weavables, wearables and wallpaper”.
- November 2016 Inquiring Minds Lecture Series “*Purls* of wisdom: Geometry & Topology of weavables, wearables and wallpaper”.
- February 2016 KITP Café Public Lecture “*Purls* of wisdom: Geometry & Topology of weavables, wearables and wallpaper”.
- Summer 2015 Harvard Materials Research Science and Engineering Center (MRSEC) 3D Printing Workshop for middle school girls, Harvard University.

MEDIA AND PUBLICITY

- May 2019 “Knitting Is Coding and Yarn Is Programmable in This Physics Lab” New York Times article featuring the Matsumoto Lab, Front cover of the Science Times <https://www.nytimes.com/2019/05/17/science/math-physics-knitting-matsumoto.html>
- April 2019 “The Science of Knitting” Physics Buzz <http://physicsbuzz.physicscentral.com/2019/04/the-science-of-knitting.html>
- March 2019 “Physicists are decoding math-y secrets of knitting to make bespoke materials” Ars Technica <https://arstechnica.com/science/2019/03/physicists-are-decoding-math-y-secrets-of-knitting-to-make-bespoke-materials/>
- March 2019 “The science of knitting, unpicked” Phys.org <https://phys.org/news/2019-03-science-unpicked.html>
- March 2019 “Mathematical rules underlie the ancient art of knitting” Science Daily <https://www.sciencedaily.com/releases/2019/03/190306081827.htm>
- March 2019 “The science of knitting may be the future of sophisticated materials” Earth.com <https://www.earth.com/news/knitting-sophisticated-materials/>
- March 2019 “Knitting our way into the future: how a centuries-old practice can revolutionize material science” ZME Science <https://www.zmescience.com/research/materials/knitting-material-science-06032019/>
- August 2017 “Bending the rules of geometry” New York Times Daily 360 video. With M Eifler, Vi Hart, Andrea Hawksley and Henry Segerman. <https://www.nytimes.com/video/science/100000005297565/bending-rules-hyperbolic-geometry-vi-hart.html>
- March 2017 “Mathematicians create warped worlds in virtual reality: Immersive experience set to become accessible to all.” Nature News https://www.nature.com/news/mathematicians-create-warped-worlds-in-virtual-reality-1.21689?WT.mc_id=TWT_NatureNews
- March 2017 “Warped reality – a virtual trip to hyperbolic space” GT Research Horizons <http://www.rh.gatech.edu/features/warped-reality>
- February 2016 “The Universe in the Heel of a Sock” UCSB The Current <http://www.news.ucsb.edu/2016/016426/it-s-all-about-curves>

STUDENTS ADVISED

- Shashank Markande, Graduate student, 2016–present
- Brian Day, Graduate student, 2017–present
- Krishma Singal, Graduate student, 2018–present
- Alexandra Carruthers, 2019–present
- Mary Elizabeth Lee, Undergraduate researcher, 2017–present

POSTDOCTORAL SCHOLARS ADVISED

- Michael Dimitriyev, Postdoctoral Scholar, 2017–present

PROFESSIONAL MEMBERSHIPS

American Physical Society
Society for Industrial and Applied Mathematics
Materials Research Society
International Liquid Crystal Society