

Emmy Murphy

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Research Interests

Symplectic and contact geometry, geometric topology.

Employment

Associate Professor, Northwestern University, 2018–present

Assistant Professor, Northwestern University, 2016–2018

Assistant Professor, Massachusetts Institute of Technology, 2014 – 2017

C L E Moore Instructor, Massachusetts Institute of Technology, 2012 – 2014

Education

Ph.D. Mathematics, Stanford University, 2012

B.S. Mathematics, University of Nevada, Reno, 2007

Publications

- “Differential algebra of cubic planar graphs”
joint with R. Casals, with an appendix by K. Sackel
To appear in *Advances in Mathematics*
<https://arxiv.org/abs/1705.01034> (2017)
- “Legendrian fronts for affine varieties”
joint with R. Casals
<https://arxiv.org/abs/1610.06977> (2016)
To appear in *Duke Mathematical Journal*
- “Conformal symplectic geometry of cotangent bundles”
joint with B. Chantraine
<https://arxiv.org/abs/1606.00861> (2016)
To appear in *Journal of Symplectic Geometry*.

- “Subflexible symplectic manifolds”
joint with K. Siegel
<http://arxiv.org/abs/1510.01867> (2015)
Geometry & Topology, **22**, no. 4, 2367–2401. (2018)
- “Making cobordisms symplectic”
joint with Y. Eliashberg
<http://arxiv.org/abs/1504.06312> (2015)
- “Geometric criteria for overtwistedness”
joint with R. Casals and F. Presas
<http://arxiv.org/abs/1503.06221> (2015)
To appear in *Journal of the AMS*
- “Amenable groups and the smooth topology of 4-manifolds”
joint with M. Freedman and L. Guth
<http://arxiv.org/abs/1503.05497> (2015)
Journal of Topology and Analysis **9**, no. 1, 1–14. (2017)
- “Existence and classification of overtwisted contact structures in all dimensions”
joint with M. S. Borman and Y. Eliashberg
<http://arxiv.org/abs/1404.6157>(2014)
Acta Mathematica **215**, no. 2, 281–361. (2015)
- “Closed exact Lagrangians in the symplectization of contact manifolds”
<http://arxiv.org/abs/1304.6620> (2013)
- “Constructing exact Lagrangian immersions with few double points”
joint with T. Ekhholm, Y. Eliashberg, and I. Smith
<https://arxiv.org/abs/1303.0588> (2013)
Geometric and Functional Analysis **23**, no. 6, 1772–1803. (2013)
- “Lagrangian caps”
joint with Y. Eliashberg
<https://arxiv.org/abs/1303.0586> (2013)
Geometric and Functional Analysis **23**, no. 5, 1483–1514. (2013)
- “Loose Legendrians and the plastikstufe”
joint with K. Niederkrüger, O. Plamenevskaya, and A. Stipsicz
<https://arxiv.org/abs/1211.3895> (2012)
Geometry & Topology, **17**, no. 3, 1791–1814. (2013)
- “Loose Legendrian embeddings in high dimensional contact manifolds”
<http://arxiv.org/abs/1201.2245> (2012)

Awards and Honors

- Invited speaker, International Congress of Mathematicians; 2018
- Séminaire Bourbaki presentation of my work with Borman and Eliashberg on higher dimensional contact structures, given by Patrick Massot; March 2017
- AWM Birman Research Prize in Topology and Geometry; 2017
- Radcliffe Institute for Advanced Studies Fellowship; academic year 2016–2017
- Académie Royale de Belgique prize for an original contribution to the existence of contact structures; 2015
- UNR College of Science Young Alumni of the Year; 2015
- Sloan Research Fellowship; 2015
- NSF award 1510305, 2015-2018
- Research Training Grant Fellow at MIT; academic year 2012–2013
- Program Associate; Symplectic and Contact Geometry and Topology Program; MSRI; academic year 2009–2010
- Regional Topology and Geometry Fellowship at Stanford; August 2007 - June 2009

Invited Talks

Colloquia and general audience talks

- “Flexibility in symplectic and contact geometry”
ETH Zürich, November 2018
- “Flexibility in symplectic and contact geometry”
International Congress of Mathematicians
Rio de Janeiro, August 2018
- “Contact geometry and knot theory”
University of Oregon, April 2018
- “Stein manifolds and contact geometry”
Western Michigan University, April 2018
- “Planar graphs and Legendrian surfaces”
Georgia Tech, December 2017
- “Planar graphs and Legendrian surfaces”
University of Illinois Urbana–Champagne, October 2017
- “Planar graphs, Legendrian surfaces, and contact homology”
University of Chicago, May 2017

- “Planar graphs and Legendrian surfaces”
Indiana University–Purdue University Indianapolis, February 2017
- “A contact topologist’s perspective on mirror symmetry”
ETH Zürich, December 2016
- “String theory and surrealism” (non-mathematical audience)
Radcliffe Institute for Advanced Study, November 2016
- “Mirror symmetry for affine varieties via geometric topology and Legendrian knot theory”
Rice University, September 2016
- “Flexibility in symplectic and contact geometry”
Northwestern University, November 2015
- “Questions in symplectic and contact flexibility”
Ludwig Maximilian University of Munich, June 2015
- “Existence of overtwisted contact structures on high dimensional manifolds”
University of California, Los Angeles, November 2014
- “Contact geometry, Legendrian curves, and parallel parking”
Smith College Lunch Seminar, November 2013
- “Lagrangian caps in \mathbb{C}^2 ”
University of Nevada, Reno, June 2012

Lecture series

- “ h -principles in contact and symplectic geometry”, five lectures
 h -principles summer graduate school
Tambara Institute of Mathematical Sciences, July 2018
- “Introduction to h -principles”, five lectures
 h -principles summer graduate school
Tambara Institute of Mathematical Sciences, June 2018
- “Applications of flexibility in high dimensional contact geometry”, five lectures
Developments in Contact and Symplectic Topology (LMS–CMI research school)
Glasgow University June 2016
- “Lefschetz fibrations, contact geometry, and flexibility”, three lectures
Geometry and related topics seminar
Research Institute for Mathematical Sciences, Kyoto University, March 2016
- “Existence of contact structures and overtwistedness in all dimensions”, four lectures
Stein Manifolds, Contact Structures and Knots conference
Centre International de Rencontres Mathématiques, September 2015

- “Loose Legendrian embeddings in high dimensional contact manifolds”, two lectures
H-principle in Houat workshop, June 2015
- “Equivalent notions of high dimensional overtwistedness”, four lectures
Gökova Geometry-Topology Conference, May 2015
- “Flexibility in higher-dimensional contact geometry”, two lectures
Workshop on Contact Geometry in Dimension Three and Higher
University College London, July 2014
- “Flexibility in higher-dimensional contact geometry”, four lectures
Université de Nantes Séminaire de Géométrie Topologie et Algèbre, January 2014
- “Lagrangian caps in high dimensional symplectic manifolds”, two lectures
Institute for Basic Sciences Center for Geometry and Physics seminar, January 2014
- “Flexibility in high dimensional contact and symplectic topology”, five lectures
Geometría Simpléctica con Técnicas Algebraicas
Centré International de Mathématiques et d’Informatique, June 2013
- “Loose Legendrian embeddings in high dimensional contact manifolds”, three lectures
Massachusetts Institute of Technology Symplectic Coffee Seminar, February 2013

Conference talks

Lectures given at conferences held in twelve countries including the following locations:

- American Institute of Mathematics
- Banaras Hindu University
- Centre International de Rencontres Mathématiques
- Cittadella dei Musei, Sardinia
- Clay Mathematics Institute
- Columbia University
- Cornell University
- Institut Mittag-Leffler
- Institute for Advanced Study
- Instituto de Ciencias Matemáticas
- Instituto Superior Técnico
- Isaac Newton Institute for Mathematical Sciences
- Laboratoire de Mathématiques Jean Leray
- Lorentz Center

- Ludwig Maximilian University of Munich
- Mathematical Sciences Research Institute
- Oklahoma State University
- Simons Center for Geometry and Physics
- Texas A & M
- Université du Québec à Montréal
- Université Libre de Bruxelles
- University of Georgia
- University of Minnesota
- University of Ottawa
- University of Texas Austin

Seminar talks

- Boston College Geometry/Topology Seminar
- Centre de Recherches Mathématiques/Université de Montréal Joint Symplectic Seminar
- Chuo University, Encounter with Mathematics 番外編 seminar
- Columbia Symplectic Geometry, Gauge Theory, and Categorification Seminar
- Dartmouth Geometry and Topology Seminar
- ETH Zürich Symplectic Geometry Seminar
- Georgia Institute of Technology Geometry/Topology Seminar
- Harvard Gauge Theory, Topology & Symplectic Geometry Seminar
- Instituto de Ciencias Matemáticas Geometry Seminar
- Microsoft Station Q Seminar
- MIT Geometry/Topology Seminar
- Northeastern Geometry, Physics, and Representation Theory Seminar
- Northwestern University Geometry/Physics Seminar
- Philadelphia Area Contact/Topology Seminar
- Princeton/IAS Symplectic Geometry Seminar
- San Francisco Bay Area Joint Symplectic Geometry Seminar
- Séminaire Orsay - Nantes de Géométrie Symplectique et de Contact
- Simons Center for Geometry and Physics/Stony Brook University Joint Topology Seminar Series
- Stanford University Symplectic Geometry Seminar

- Stony Brook University Thursday Topology Seminar
- Université Libre de Bruxelles Geometry & Topology Seminar
- Université de Nantes Séminaire de Géométrie Topologie et Algèbre
- University of California, Los Angeles Topology Seminar
- University of Georgia Topology Seminar
- University of Illinois, Urbana-Champaign Symplectic & Poisson Geometry Seminar
- University of Massachusetts-Amherst Geometry Seminar
- University of Tokyo, Tuesday Seminar on Topology
- University of Wisconsin, Madison Geometry and Topology Seminar

Teaching Experience

Math 440-1 (Introductory Differential Topology and Geometry), Instructor, Northwestern. Fall 2017, Fall 2018.

Math 460-2 (Morse theory), Instructor, Northwestern. Winter 2018.

Math 440-2 (Introduction to Homotopy theory), Instructor, Northwestern. Winter 2018.

Math 18.937 (Introduction to h -principles), Instructor, MIT. Spring 2016.

Math 18.100C (Introductory Real Analysis, communication intensive), Instructor, MIT. Fall 2015.

Math 18.965 (Introductory Differential Topology and Geometry), Instructor, MIT. Fall 2014.

Math 18.966 (Introductory Contact Geometry), Instructor, MIT. Spring 2014.

Math 18.02 (Vector Calculus), Teaching Assistant, MIT. Spring 2015, Fall 2013, Fall 2012.

Math 18.03 (Ordinary Differential Equations), Teaching Assistant, MIT. Spring 2013.

Math 21 (Sequences, Series, Intro to Differential Equations), Teaching Assistant, Stanford. Spring 2012.

Math 51 (Linear Algebra and Vector Calculus), Teaching Assistant, Stanford. Winter 2011, Winter 2010.

Service

Associate Editor, *Virtual series in symplectic geometry*, Springer. 2017—Present.

Organizer, “ h -principles summer graduate school”, Palazzone di Cortona, August 2019.

Faculty Senator for the Department of Mathematics, Northwestern. 2018–2022.

Member of the GQNB task force, Northwestern, 2018–2019.

Organizer, “Yashafest 2018” conference, Asilomar, CA. 31 participants, August 2018.

Organizer, “ h -principles summer graduate school”, Tambara Institute of Mathematics. 30 participants, August 2018.

Boas Assistant Professor hiring committee member, Northwestern, 2018.

Organizer, “Engel structures workshop”, American Institute of Mathematics. 29 participants, March 2017.

Scientific committee chair, “ L_3 workshop in symplectic geometry”, January 2016.

Organizer, Geometry and Topology Seminar at MIT, Fall 2013 – Spring 2016.

Graduate admission committee member at MIT, 2015

Organizer, “Overtwistedness in High Dimensions” workshop, Asilomar, CA. 23 participants, May 2014.

Organizer, “Recent Progress in Symplectic Flexibility” workshop, Asilomar, CA. ≈ 25 participants, April 2013.

Personal

United States Citizen.

Last updated: November 13, 2018