

# Robin Neumayer

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## *Curriculum Vitae*

### Education

- 2017 **Ph.D. in Mathematics**, *University of Texas*, Austin.  
Supervised by Alessio Figalli and Francesco Maggi.
- 2014 **M.A. in Mathematics**, *University of Texas*, Austin.
- 2012 **B.S. in Mathematics**, *University of South Carolina*, Columbia.  
Summa cum laude, degree with distinction, minor in business.

### Academic Appointments

- 2023– **Carnegie Mellon University**, Assistant Professor.
- 2021–2023 **Carnegie Mellon University**, Gregg Zeitlin Early Career Professor.  
(Tenure-track Assistant Professor.)
- 2017–2021 **Northwestern University**, RTG Postdoctoral Fellow.  
On leave for 2018–2019 academic year.
- 2018–2019 **Institute for Advanced Study**, Member.  
For the Variational Methods in Geometry special year.

### Grants and Awards

- 2022–2025 **NSF Grant**, DMS-2155054.  
“Stability and Regularity: From Analysis to Geometry.”
- 2021–2023 **Gregg Zeitlin Early Career Chair**.
- 2019–2022 **NSF Grant**, DMS-1901427 (renamed DMS-2200886 upon moving to CMU).  
“Stability of functional and geometric inequalities and applications.”
- 2019 **AWM Travel Grant**.  
Declined after receiving NSF grant.
- 2019 **US Junior Oberwolfach Fellow**.
- 2018 **Oberwolfach Leibniz Graduate Student**.
- 2017 **AustMS Travel Award**.  
For the International Conference on PDEs, Geometric Analysis, and Functional Analysis in Sydney, Australia.
- 2012–2017 **NSF Graduate Research Fellowship**, DGE-1110007.
- 2012–2013 **Graduate Fellowship**, UT Department of Mathematics.

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- 2012 **Outstanding Student of Mathematics Award**, University of South Carolina.
- 2011 **Rising Senior in Mathematics Award**, University of South Carolina.

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## Research Publications

- [1] **Local minimizers of the anisotropic isoperimetric problem on closed manifolds.**  
A. De Rosa and R. Neumayer. Preprint available at arXiv: 2308.04565.
- [2] **Epsilon regularity under scalar curvature and entropy lower bounds and volume upper bounds.**  
R. Neumayer. Preprint available at arXiv:2206.12386.
- [3] **Rectifiability and uniqueness of blowups for points with positive Alt-Caffarelli-Friedman limit.**  
M. Allen, D. Kriventsov, and R. Neumayer. Preprint available at arXiv:2210.03552.
- [4] **Rigidity theorems for best Sobolev inequalities.**  
F. Maggi, R. Neumayer, and I. Tomasetti. *Adv. Math.* Volume 434, 2023, 109330.
- [5] **Sharp quantitative Faber-Krahn inequalities and the Alt-Caffarelli-Friedman monotonicity formula.**  
M. Allen, D. Kriventsov, and R. Neumayer. *Ars Inven. Anal.* 2023, Paper No. 1, 49 pp.
- [6] **Linear Stability Implies Nonlinear Stability for Faber-Krahn Type Inequalities.**  
M. Allen, D. Kriventsov, and R. Neumayer. *Interfaces Free Bound.* 25(2):217–324, 2023.
- [7]  **$d_p$  Convergence and  $\epsilon$ -regularity theorems for entropy and scalar curvature lower bounds.**  
M.-C. Lee, A. Naber, and R. Neumayer. *Geom. Topol.*, 27-1 (2023), 227–350.
- [8] **Quantitative stability for minimizing Yamabe metrics.**  
M. Engelstein, R. Neumayer, and L. Spolaor. *Trans. Amer. Math. Soc. Ser. B.*, 9 (2022) 395-414.
- [9] **A note on strong-form stability for the Sobolev inequality.**  
R. Neumayer. *Calc. Var. Partial Differential Equations*, 59 (2020), no. 1, Paper No. 25, 8pp.
- [10] **Anisotropic liquid drop models.**  
R. Choksi, R. Neumayer, and I. Topaloglu. *Adv. Calc. Var.*, 15 (2022), no. 1, 109-131.
- [11] **Bubbling with  $L^2$ -almost constant mean curvature and an Alexandrov-type theorem for crystals.**  
M.G. Delgadino, F. Maggi, C. Mihaila, and R. Neumayer. *Arch. Ration. Mech. Anal.* 230 (2018) no. 3, 1131–1177.

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- [12] **The Cheeger constant of a Jordan domain without necks.**  
G.P. Leonardi, R. Neumayer, and G. Saracco. *Calc. Var. Partial Differential Equations.* **56** (2017), no. 6, Art. 164, 29 pp.
- [13] **A bridge between Sobolev and Escobar inequalities and beyond.**  
F. Maggi and R. Neumayer. *J. Funct. Anal.* **273** (2017), no. 6, 2070–2106.
- [14] **Higher regularity of the free boundary for the fractional obstacle problem.**  
Y. Jhaveri and R. Neumayer, *Adv. Math.* **311** (2017), 748–795.
- [15] **Gradient stability for the Sobolev inequality: the case  $p \geq 2$ .**  
A. Figalli and R. Neumayer. *J. Eur. Math. Soc. (JEMS)* **21** (2019), no. 2, 319–354.
- [16] **A strong form of the quantitative Wulff inequality.**  
R. Neumayer. *SIAM J. Math. Anal.* **48** (2016), no. 3, 1727–1772.
- [17] **A note on the stability of the Cheeger constant of  $N$ -gons.**  
M. Carocchia and R. Neumayer. *J. Convex Anal.* **22** (2015), no. 4, 1207–1213.

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## Other Publications – Book Chapters, Proceedings, and Thesis

- [18] **Epsilon regularity for spaces with scalar curvature lower bounds.**  
R. Neumayer. To appear in *Differentialgeometrie im Grossen. Oberwolfach Report*.
- [19] **Existence of Extremals and Rigidity for Optimal Sobolev Inequalities.**  
R. Neumayer. In: *Geometrie. Oberwolfach Rep.* 19 (2022), no. 2, pp. 1551–1601
- [20] **Convergence and regularity of manifolds with scalar curvature and entropy lower bounds.**  
M.-C. Lee, A. Naber, and R. Neumayer. *Perspectives in Scalar Curvature.* Vol. 1, pages 543–576. World. Sci. Publ., Hackensack, NJ, 2023.
- [21] **Characterizing minimizers of a constrained planar isoperimetric problem.**  
R. Neumayer. In: *Partial Differential Equations. Oberwolfach Rep.* **16** (2019), no. 3, 2046–2048.
- [22] **On minimizers and critical points for anisotropic isoperimetric problems.**  
R. Neumayer. *2018 Matrix Annals*, 293–302.
- [23] **Mass transportation methods in functional inequalities and a new family of sharp constrained Sobolev inequalities.**  
R. Neumayer. *RIMS Kôkyûroku* (2017), no. 2046, 39–49.
- [24] **Stability and minimality properties in Sobolev and isoperimetric inequalities.**  
R. Neumayer. Ph.D. thesis containing the results of [13], [15], and [16]. Available at <https://www.math.cmu.edu/~rneumaye>.

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## Invited Conference Talks (including upcoming/scheduled)

- July 2024 Geometry of Measures and Free Boundaries; a Conference in Honor of Tatiana Toro (University of Washington)
- July 2023 Oberwolfach Workshop on Differentialgeometrie im Grossen
- June 2023 Regularity Theory for Free Boundary and Geometric Variational Problems (Levico Terme)
- Nov. 2022 Aspects of Ricci curvature bounds (Fields Institute)
- June 2022 Oberwolfach Workshop on Geometry
- May 2022 Rutgers Geometric Analysis Conference
- Sept. 2021 Sampling Algorithms and Geometries on Probability Distributions Workshop (Simons Institute for the Theory of Computing, Virtual)
- Sept. 2021 Research on Variational Problems and Partial Differential Equations with a Critical Exponent (Osaka City University, Virtual, series of two talks)
- Sept. 2021 Regularity Theory for Free Boundary and Geometric Variational Problems (Levico Terme)
- May 2021 John Barrett Memorial Lectures (University of Tennessee, Virtual)
- March 2021 AMS Sectional Meeting (Virtual)  
Special Session on “Geometric and Functional Inequalities and Nonlinear Partial Differential Equations”
- Feb. 2021 Geometric and functional inequalities and recent topics in nonlinear PDEs (Virtual)
- Feb. 2021 Seminario Interuniversitario de Investigación en Ciencias Matemáticas (Virtual)
- Jan. 2021 Joint Mathematics Meeting (Virtual)  
Special Session on “PDEs in optimization, control, and games”
- Nov. 2019 AMS Sectional Meeting (UC Riverside)  
Special Session on “Analysis of Nonlinear Partial Differential Equations and Applications”
- Oct. 2019 Modern Math Workshop (Honolulu, HI, Satellite of SACNAS National Conference)  
Research Session and IAS/PCMI Representative
- Oct. 2019 Local and Nonlocal Trends in Analysis and Geometry (University of Pittsburgh)
- Sept. 2019 Dynamics, Equations, and Applications (AGH UST, Kraków, Poland)
- July 2019 Oberwolfach Workshop on Partial Differential Equations
- June 2019 RTG Conference on Geometric Analysis (Princeton University)
- May 2019 Geometry Workshop (University of British Columbia)
- April 2019 AMS Sectional Meeting (University of Connecticut)  
Special Session on “Regularity Theory of PDEs and Calculus of Variations on Domains with Rough Boundaries”

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- March 2019 AMS Sectional Meeting (University of Hawaii)  
 Special Session on “Analysis of Nonlinear Geometric Equations”  
 Special Session on “New Trends in Geometric Measure Theory”  
 Special Session on “Interactions between Geometric Measure Theory, PDE, and Harmonic Analysis”
- Nov. 2018 Recent Trends in Nonlinear PDEs of Elliptic and Parabolic Type (MATRIX Institute)
- Nov. 2018 Recent Trends in Nonlinear PDEs (University of Sydney)
- Oct. 2018 82nd Midwest PDE Seminar (Purdue University)
- July 2018 Workshop for Women in Differential Equations (Universidade Federal do ABC, Santo André, Brazil)
- July 2018 PCMI Research Program in Harmonic Analysis
- April 2018 81st Midwest PDE Seminar (University of Wisconsin)
- April 2018 AMS Sectional Meeting (Portland State University)  
 Special session on “Analysis at the intersection of Geometric Measure Theory and Partial Differential Equations”
- April 2018 6th Annual Midwest Women in Mathematics Symposium (Purdue University)
- April 2018 Graduate Student Topology and Geometry Conference (University of Illinois at Chicago)
- July 2017 Mathematical Congress of the Americas (Montreal)  
 Special session on “Nonlocal Variational Problems”
- March 2017 International Conference on PDEs, Geometric Analysis and Functional Inequalities (University of Sydney)
- Nov. 2016 RIMS Workshop on Analysis on Shapes of Solutions to Partial Differential Equations (Kyoto University)
- July 2016 AIMS Conference on Dynamical Systems, Differential Equations and Applications (Orlando, FL)  
 Special session on “Geometric functional inequalities and application to PDEs”  
 Special session on “Quantitative geometric and functional inequalities and new trends in nonlinear PDEs”

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### Colloquia (including upcoming/scheduled)

- Nov. 2022 Colloque des Sciences Mathématiques, Montreal
- Nov. 2022 Colloquium, Stony Brook University
- Oct. 2022 Colloquium, McMaster University
- Dec. 2021 Colloquium, Rice University
- Nov. 2021 MATH-IMS Joint Pure Mathematics Colloquium, Chinese University of Hong Kong (Virtual)
- Nov. 2021 Colloquium, Rice University
- Oct. 2021 Colloquium, University of South Carolina (Virtual)

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- July 2021 Hua Luogeng's Forum, Institute of Mathematics, Chinese Academy of Sciences (Virtual, three-hour series of talks)
- Feb. 2021 Colloquium, Purdue (Virtual)
- Feb. 2021 Colloquium, Carnegie Mellon (Virtual)
- Feb. 2021 Colloquium, Rutgers (Virtual)
- Jan. 2021 Colloquium, UC Santa Cruz (Virtual)
- Jan. 2021 Colloquium, University of Toronto (Virtual)
- Dec. 2020 Colloquium, Texas A&M (Virtual)
- Dec. 2020 Colloquium, Notre Dame (Virtual)
- Nov. 2019 Colloquium, University of Pennsylvania

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### Seminar Talks (including upcoming/scheduled)

- March 2024 GAP Seminar, Penn State
- April 2023 PDE-Applied Math Seminar, University of Maryland
- March 2023 Online PDE Seminar, Virtual
- Feb. 2023 Differential Geometry and Geometric Analysis Seminar, Princeton
- Sept. 2022 Analysis, PDE and Applied Math Seminar, University of Toronto
- April 2022 Geometric Analysis and Topology Seminar, Courant Institute (Virtual)
- April 2022 Nonlinear Analysis Seminar, NC State University (Virtual)
- March 2022 Analysis and Geometry Seminar, Columbia University
- Feb. 2022 Analysis Webinar, University of Leeds (Virtual)
- Jan. 2022 Analysis and PDE Seminar, Universidad Autónoma de Madrid (Virtual)
- Nov. 2021 Calderon-Zygmund Seminar, University of Chicago (Virtual)
- Nov. 2021 Analysis Seminar, UT Austin
- Oct. 2021 Geometry/Topology Seminar, Stony Brook (Virtual)
- Oct. 2021 Geometric Analysis Seminar, Rutgers (Virtual)
- June 2021 Oberseminar Differential Geometry, University of Münster (Virtual)
- April 2021 Oberseminar Analysis-Probability, Max Planck Institute, Leipzig (Virtual)
- April 2021 Geometric Analysis Seminar, Cornell (Virtual)
- March 2021 B.O.W.L. Online Geometry Seminar (Virtual)
- March 2021 Harmonic Analysis, GMT, and PDE Seminar, University of Minnesota and University of Missouri (Virtual)
- March 2021 Differential Geometry and Geometric Analysis Seminar, Princeton (Virtual)
- Feb. 2021 PDE Seminar, Oxford (Virtual)
- Feb. 2021 Geometric Analysis Seminar, UC San Diego (Virtual)
- Feb. 2021 Geometric Analysis Seminar, University of Chicago (Virtual)
- Feb. 2021 Analysis Seminar, University of Trento (Virtual)
- Feb. 2021 Applied PDEs Seminar, Imperial College London (Virtual)

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- Feb. 2021 Topology and Geometry Seminar, Duke University (Virtual)
- Jan. 2021 Analysis Seminar, Cal Tech (Virtual)
- Nov. 2020 Webinários do PPGMat, UFRGS (Virtual)
- Nov. 2020 Geometric Analysis Seminar, CUNY (Virtual)
- Oct. 2020 PDE/Analysis Seminar, University of Minnesota (Virtual)
- Oct. 2020 Analysis Seminar, Georgia Tech (Virtual)
- Dec. 2019 Geometry Seminar, University of Notre Dame
- Sept. 2019 PDE/Applied Math Seminar, Indiana University
- Sept. 2019 PDE Seminar, Brown University
- Aug. 2019 Departmental Seminar, Duke University
- April 2019 Geometry and Analysis Seminar, Columbia University
- April 2019 Analysis Seminar, University of Pennsylvania
- April 2019 Nonlinear Analysis Seminar, Rutgers University
- Feb. 2019 Variational Methods in Geometry Seminar, Institute for Advanced Study
- Feb. 2019 Analysis Seminar, Princeton University
- Jan. 2019 Geometric Analysis Seminar, University of Tennessee
- April 2018 SEDNOL Seminar, Universidad Nacional Autónoma de México
- March 2018 Analysis Seminar, Michigan State University
- Jan. 2018 Geometric Analysis Seminar, University of Chicago
- Nov. 2017 Rainwater Seminar, University of Washington
- Oct. 2017 Analysis Seminar, Johns Hopkins University
- Oct. 2017 CAMP Seminar, University of Chicago
- April 2017 Geometry and Analysis Seminar, Columbia University
- March 2017 Analysis Seminar, University of Florence
- Feb. 2017 Analysis Seminar, University of Modena and Reggio Emilia
- Jan. 2017 Analysis Seminar, Northwestern University
- Jan. 2016 CNA Seminar, Center for Nonlinear Analysis, Carnegie Mellon University
- Dec. 2015 PDE Seminar, Purdue University
- Nov. 2015 Analysis Seminar, University of Modena and Reggio Emilia
- Oct. 2015 Analysis Seminar, École Normale Supérieure de Lyon
- Sept. 2014 Analysis Seminar, ETH Zürich
- June 2014 Seminar for Elliptic PDEs, Weierstrauss Institute, Berlin

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## Mini-Courses

- July 2024 **Instructor**, TBA.  
Six-hour mini-course at Summer School on Geometric Analysis and PDEs at Bedlewo Conference Center in Poland.



- June 2023 **Instructor**, Shape Optimization: From Soap Films to Acoustics.  
Three-hour mini-course aimed at undergraduate STEM students at CMU Data Analytics for Science Immersion Experience (DASIE) Program.
- June 2022 **Instructor**, Shape Optimization: From Soap Films to Acoustics to Crystals.  
Three-hour mini-course aimed at undergraduate STEM students at CMU Data Analytics for Science Immersion Experience (DASIE) Program.
- May 2022 **Instructor**, Scalar Curvature: Structure and Regularity.  
Two-hour mini-course aimed at graduate students at Rutgers University Geometric Analysis Conference.
- May 2022 **Instructor**, An Introduction to  $d_p$  Convergence of Riemannian Manifolds.  
Three-hour mini-course aimed at researchers at CMSA Workshop on Scalar Curvature, Minimal Surfaces, and Initial Data Sets.
- May 2019 **Teaching Assistant**, Ancient Solutions to Geometric Flows.  
Mini-course aimed at graduate students taught by P. Daskalopoulos, Topics in Geometric Analysis Summer School for Women in Mathematics, Institute for Advanced Study.

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## Teaching

### Carnegie Mellon University

- Fall 2023 **Instructor**, Introduction to Differential Equations.
- Spring 2023 **Instructor**, Real Analysis.
- Spring 2022 **Instructor**, Real Analysis.
- Fall 2021 **Instructor**, Differential Geometry of Curves and Surfaces.

### Northwestern University

- Spring 2021 **Instructor**, Optimal Transport and Applications (Graduate Topics Class).
- Spring 2021 **Instructor**, Elementary Differential Equations.
- Fall 2020 **Instructor**, Introduction to Differential Geometry.
- Winter 2020 **Instructor**, Foundations of Higher Mathematics.
- Fall 2019 **Instructor**, Single-Variable Differential Calculus.
- Winter 2018 **Instructor**, Differential Calculus of Multivariable Functions.
- Fall 2017 **Instructor**, Integral Calculus of One-Variable Functions.

### University of Texas at Austin

- Spring 2016 **Teaching Assistant**, Integral and Multivariable Calculus.

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## Mentorship

- Summer 2023 **Summer Undergraduate Research Mentor**, Carnegie Mellon University.  
Supervised undergraduate research for I. Jiang, an undergraduate math and physics student at CMU.

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Fall **Reading and Research Course Supervisor**, Carnegie Mellon University.  
2021-Spring Supervised reading and research course for Ph.D. student W. Caldwell.  
2022

Summer **REU Mentor**, University of Chicago Mathematics REU.  
2020 Served as the REU mentor for K. DeMason, an undergraduate who was an unofficial participant in the University of Chicago Mathematics REU.

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## Conference Organization

Jan. 2020 **Co-organizer**, Special Session “Interfaces between PDEs and Geometric Measure Theory” at Joint Mathematics Meetings (Denver, CO).

With Z. Zhao.

July 2018 **Co-organizer**, Special Session “Recent Advances in the Calculus of Variations and Elliptic PDE” at AIMS Conference on Dynamical Systems, Differential Equations and Applications (Taipei, Taiwan).

With C. Mooney.

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## Service

2023– **Faculty Mentor**, SIAM Student Chapter, Carnegie Mellon University.

Spring 2023 **Organizer**, CNA Seminar, Carnegie Mellon University.

Ongoing **Referee**, for the following journals.

*Advances in the Calculus of Variations; Annali della Scuola Normale Superiore di Pisa; Annali di Matematica Pura ed Applicata; Annales de l'Institut Henri Poincaré C: Analyse non linéaire Archive for Rational Mechanics and Analysis Communications in Analysis and Geometry; Communications in Partial Differential Equations; Geometriae Dedicata; International Mathematics Research Notices; Journal of Geometric Analysis; Journal of Nonlinear Science; Memoirs of the American Mathematical Society; Nonlinear Analysis; Revista Matemática Iberoamericana; SIAM Journal on Mathematical Analysis.*

April 2022 **Speaker**, Undergraduate Colloquium, Northwestern University.

Oct. 2021 **Panelist**, Impostor Syndrome Panel, Undergraduate Math Club, Carnegie Mellon University.

Oct. 2021 **Panelist**, “What is Research in Math?” Panel, Graduate Research Opportunities for Women (GROW).

Oct. 2021 **Speaker**, Undergraduate Math Club, Carnegie Mellon University.

Jan. 2021 **Judge**, AWM Poster Session, Joint Mathematics Meetings.

Oct. 2020 **Panelist**, Academic Job Panel, Northwestern University.

Oct. 2019 **IAS/PCMI Representative**, Modern Math Workshop (Satellite of SACNAS National Conference), Honolulu, HI.

Oct. 2019 **Panelist**, Academic Job Panel, Northwestern University.

2019–2020 **Faculty mentor**, Directed Reading Program, Northwestern University.

2019–2021 **Organizer**, Women in Math Program, Northwestern University.

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- 2019–2020 **Committee Member**, Climate Committee, Northwestern University.  
Postdoctoral representative for committee aimed at addressing departmental concerns.
- 2018–2019 **Co-organizer**, Women in Math Lunches, Institute for Advanced Study.  
with A. Bucur.
- Nov. 2018 **Speaker**, Mathematical Conversations, Institute for Advanced Study.
- Oct. 2017 **Volunteer**, Graduate Research Opportunities for Women (GROW).  
Conference for undergraduate women in mathematics at Northwestern University. Participated in conference and breakout mentoring session.
- March 2017 **Panelist**, “Promoting Gender Diversity in Mathematics” Discussion Panel, International Conference on PDEs, Geometric Analysis and Functional Inequalities (University of Sydney).
- 2013–2016 **Co-organizer**, Distinguished Women in Mathematics (DWM) Program, UT Austin.  
Managed the website, invited speakers, and helped organize visits for DWM, a program and lecture series bringing accomplished female mathematicians to UT Austin.
- April 2016 **Speaker**, Undergraduate Math Club, UT Austin.
- May 2015 **Organizer**, Math Day, The Girls’ School of Austin.  
Planned and directed interactive math activities for a first grade class.
- Nov. 2014 **Speaker**, “They Blinded Me With Science” science radio show on Austin radio station KVRX.
- Nov. 2014 **Speaker**, Undergraduate Math Club, UT Austin.
- Spring 2014 **Mentor**, IE Pre-Graduate School Internship Program, UT Austin.  
Directed an independent study on measure theory taken by an undergraduate student for course credit.
- Fall 2013 **Mentor**, Directed Reading Program, UT Austin.  
Directed a reading course on optimal transport for an undergraduate student.
- 2012–2015 **Tutor and aid**.  
Worked weekly with a disabled high school student in Austin.