

## EDUCATION

### Ph.D in Mathematics

Yale University, 2015

### B.S. in Mathematics, *with honors*

University of Chicago, 2010

## ACADEMIC POSITIONS

### Associate Professor

University of Minnesota, Twin Cities, 2024 – present

### Assistant Professor

University of Minnesota, Twin Cities, 2018 – 2024

### Postdoctoral Research Associate

Princeton University, 2015 – 2018

## PUBLICATIONS

1. Matan Gavish, William Leeb and Elad Romanov. Matrix Denoising with Partial Noise Statistics: Optimal Singular Value Shrinkage of Spiked F-Matrices. *Information and Inference: A Journal of the IMA* 12, no. 3 (2023): 2020-2065.
2. Tamir Bendory, Nicolas Boumal, William Leeb, Eitan Levin and Amit Singer. Toward single-particle reconstruction without particle picking: Breaking the detection limit. *SIAM Journal on Imaging Sciences* 16, no. 2 (2023): 886-910.
3. William Leeb. Optimal singular value shrinkage for operator norm loss: Extending to non-square matrices. *Statistics and Probability Letters* 186 (2022): 109472.
4. Tamir Bendory, Dan Edidin, William Leeb and Nir Sharon. Dihedral multi-reference alignment. *IEEE Transactions on Information Theory* 68, no. 5 (2022): 3489-3499.
5. Tamir Bendory, Ariel Jaffe, William Leeb, Nir Sharon and Amit Singer. Super-resolution multi-reference alignment. *Information and Inference: A Journal of the IMA* 11, no. 2 (2022): 533-555.
6. William Leeb. Rapid evaluation of the spectral signal detection threshold and Stieltjes transform. *Advances in Computational Mathematics* 47, no. 60 (2021).
7. William Leeb. Matrix denoising for weighted loss functions and heterogeneous signals. *SIAM Journal on Mathematics of Data Science* 3, no. 3 (2021): 987-1012.
8. William Leeb. A note on identifiability conditions in confirmatory factor analysis. *Statistics and Probability Letters* 178 (2021): 10919.
9. William Leeb and Elad Romanov. Optimal spectral shrinkage and PCA with heteroscedastic noise. *IEEE Transactions on Information Theory* 67, no. 5 (2021): 3009-3037.
10. Edgar Dobriban, William Leeb and Amit Singer. Optimal prediction in the linearly transformed spiked model. *Annals of Statistics* 48, no. 1 (2020): 491-513.
11. William Leeb and Vladimir Rokhlin. On the numerical solution of fourth-order linear two-point boundary value problems. *SIAM Journal on Scientific Computation* 42, no. 3, (2020): A1789-A1808.

12. Emmanuel Abbe, Tamir Bendory, William Leeb, João Pereira, Nir Sharon and Amit Singer. Multireference alignment is easier with an aperiodic translation distribution. *IEEE Transactions on Information Theory* 65, no. 6, (2019): 3565-3584.
13. Tamir Bendory, Nicolas Boumal, William Leeb, Eitan Levin and Amit Singer. Multi-target detection with application to cryo-electron microscopy. *Inverse Problems* 35, no. 10 (2019): 104003.
14. Jerrod Ankenman and William Leeb. Mixed Hölder matrix discovery via wavelet shrinkage and Calderón-Zygmund decompositions. *Applied and Computational Harmonic Analysis* 45, no. 3, (2018): 551-596.
15. William Leeb. Approximating snowflake metrics by trees. *Applied and Computational Harmonic Analysis* 45, no. 2, (2018): 405-424.
16. William Leeb. The mixed Lipschitz space and its dual for tree metrics. *Applied and Computational Harmonic Analysis* 44, no. 3, (2018): 584-610.
17. William Leeb and Ronald Coifman. Hölder-Lipschitz norms and their duals on spaces with semigroups, with applications to Earth Mover's Distance. *Journal of Fourier Analysis and Applications* 22, no. 4, (2016): 910-953.

## PRE-PRINTS / TECHNICAL REPORTS

1. William Leeb. On sliced Cramér metrics. arXiv 2508.02678 (2025).
2. William Leeb. On metrics robust to noise and deformations. arXiv 2101.10867v3 (2024).
3. William Leeb. Properties of Laplacian Pyramids for Extension and Denoising. arXiv 1909.07974 (2019).

## TALKS / PRESENTATIONS

- Signal recovery in the high-noise, high-dimensional regime. Probability Seminar, University of Wisconsin-Madison. April 24, 2025.
- Fast and Robust Metrics. Applied Math/PDE Seminar, University of California, Santa Barbara. November 8, 2024.
- Metrics Robust to Deformations and Noise. Computational Harmonic Analysis and Data Science Workshop, BIRS. Oaxaca, Mexico. September 19, 2024.
- Signal recovery in the high-noise, high-dimensional regime. Computer Science Colloquium, Rensselaer Polytechnic Institute. April 17, 2024.
- Signal recovery in the high-noise regime. Mathematics Colloquium, University of Minnesota, Twin Cities. October 12, 2023.
- Group-robust Metrics. International Congress on Industrial and Applied Mathematics (ICIAM), Minisymposium on Estimation problems over groups. Tokyo, Japan. August 25, 2023.
- New Methods for Low-Rank Matrix Denoising. Applied Math Colloquium, Tel Aviv University. November 22, 2022.
- Robust Metrics by Integration. SIAM Conference on Mathematics of Data Science (MDS22), Minisymposium on Geometric Distances and Robust Data Analysis. September 28, 2022.
- New Methods for Low-Rank Matrix Denoising. Oden Institute, University of Texas at Austin. May 10, 2022.
- New Methods for Low-Rank Matrix Denoising. Yale University Applied Math Seminar. December 15, 2021.

- New Methods for Low-Rank Matrix Denoising. Duke University Applied Math and Analysis Seminar. December 14, 2021.
- Matrix Denoising with Weighted Loss. KTH Royal Institute of Technology. April 12, 2021.
- Matrix Denoising with Weighted Loss. Computational and Applied Mathematics Colloquium, University of Chicago. March 18, 2021.
- Matrix Denoising with Weighted Loss. Data Science Seminar, Institute for Mathematics and its Applications. September 22, 2020.
- Missing Data in the High Noise Regime. Virtual poster session, Workshop on Missing Data Challenges in Computation, Statistics, and Applications. Institute for Advanced Study. September 10, 2020.
- Matrix Denoising with Weighted Loss. SIAM Conference on Mathematics of Data Science (MDS20, virtual conference), Minisymposium on High-Dimensional PCA in the High-Noise Regime. June 24, 2020.
- Matrix Denoising with Weighted Loss. Mathematics of Data and Decisions Seminar, University of California, Davis. March 10, 2020.
- Matrix Estimation in the Spiked Model with Heteroscedastic Noise. Computational Harmonic Analysis and Data Science Workshop, BIRS. Oaxaca, Mexico. October 29, 2019.
- New Methods for Denoising and CTF Correction. Poster session, Computational Cryo-EM Summer Workshop. Flatiron Institute. August 8, 2019.
- Dual Norms on Product Spaces. International Congress on Industrial and Applied Mathematics (ICIAM), Minisymposium on Distance Metrics and Mass Transfer Between High Dimensional Point Clouds. Valencia, Spain. July 17, 2019.
- Matrix Denoising and PCA with Heteroscedastic Noise. Center for Computational Mathematics Seminar, Flatiron Institute. New York, NY. May 29, 2019.
- Matrix Denoising and PCA with Heteroscedastic Noise. IDeAS Seminar, Princeton University. Princeton, NJ. May 28, 2019.
- Matrix Denoising and PCA with Heteroscedastic Noise. Applied Math and Computer Science Colloquium, University of Pennsylvania. Philadelphia, PA. May 24, 2019.
- Optimal Spectral Shrinkage and PCA with Heteroscedastic Noise. Applied Math Seminar, Yale University. New Haven, CT. April 23, 2019.
- Optimal Spectral Shrinkage and PCA with Heteroscedastic Noise. Probability Seminar, University of Minnesota. Minneapolis, MN. April 19, 2019.
- Optimal Spectral Shrinkage and PCA with Heteroscedastic Noise. Analysis Seminar, University of Missouri. Columbia, MO. March 19, 2019.
- SIAM 5-Minute Faculty Research Showcase, University of Minnesota. March 6, 2019.
- The Role of the Translation Distribution in Multireference Alignment. Data Science Seminar, Institute for Mathematics and its Applications. September 17, 2018.
- Prediction in the Linearly Transformed Spiked Model. Fourth Conference of the International Society of Nonparametric Statistics (ISNPS). Salerno, Italy. June 12, 2018.
- Optimal Prediction in the Linearly Transformed Spiked Model. Data Science Seminar, Institute for Mathematics and its Applications. December 8, 2017.

- MRA is Easier with an Aperiodic Translation Distribution. Simons Foundation, New York. November 10, 2017.
- PCA from Noisy, High-Dimensional and Linearly-Corrupted Observations. Poster session, Modern Advances in Computational and Applied Mathematics Workshop, Yale University. June 9, 2017.
- PCA from Linearly Reduced Measurements: The Diagonal Case. Applied Mathematics Seminar, Yale University. December 13, 2016.
- Earth Mover's Distance and Equivalent Metrics. Machine Learning Seminar, Yale University. February 17, 2016.
- The Mixed Hölder Condition, with Applications to the Analysis of Multidimensional Databases. Simons Foundation, New York. January 29, 2016.
- The Hölder-Lipschitz Space and its Dual. International Conference on Harmonic Analysis and Applications, City University of New York. June 5, 2015.
- Earth Mover's Distance and Equivalent Metrics. IDeAS Seminar, Princeton University. March 26, 2014.

## AWARDS / RECOGNITION

- **McKnight Presidential Fellow**  
University of Minnesota, Spring 2024
- **George W. Taylor Career Development Award**  
University of Minnesota, Spring 2024
- **NSF CAREER Award**  
Awarded January, 2023
- **Thank a Teacher**  
University of Minnesota, Fall 2019 and Spring 2020
- **Paul R. Cohen Prize**  
University of Chicago, 2010
- **Phi Beta Kappa**  
University of Chicago, 2009 (elected Junior year)
- **Student Marshal**  
University of Chicago, 2009

## FUNDING

- PI, NSF CAREER Award 2238821, 2023 – 2028. \$500,000 total.
- PI, BSF Award 2018230, 2019 – 2022. With Nir Sharon (PI, Tel Aviv University). \$120,000 total/\$60,000 Minnesota.
- Co-PI, NSF BIGDATA Award IIS-1837992, 2018 – 2022. With Amit Singer (PI, Princeton University) and Edgar Dobriban (Co-PI, University of Pennsylvania). \$1,000,000 total/\$333,333 Minnesota.
- Simons Collaboration on Algorithms and Geometry postdoctoral grant, 2015 – 2018.