

25.12.2016

## Curriculum Vitae – Emanuel Milman

Date and place of birth: January 12, 1977, Israel.

Marital Status: Married + 2.

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### Academic Degrees:

2007 - Ph.D., Pure Mathematics, The Weizmann Institute of Science.

Supervisor: Prof. Gideon Schechtman.

Thesis: *On the Distribution of Volume in Convex Bodies*.

2000 - M.Sc. Summa Cum Laude (GPA 99), Pure Mathematics, Tel-Aviv University.

Supervisor: Prof. Ehud Lehrer.

Thesis: *Uniform Properties of Stochastic Games and Approachability*.

1996 - B.Sc. Summa Cum Laude (GPA 98), Mathematics and Computer Science, Tel-Aviv University.

### Academic Appointments:

8-12/2017 – Research Professor, MSRI (special program on “Geometric Functional Analysis and Applications”).

2012 – Tenured Associate Professor, Department of Mathematics, Technion - I.I.T., Haifa.

2010 – Senior Lecturer, Department of Mathematics, Technion - I.I.T., Haifa.

2009 - 2010 – Post-Doctoral Fellow, Department of Mathematics and Fields Institute, University of Toronto.

2007 - 2009 – Post-Doctoral Member, School of Mathematics, Institute for Advanced Study, Princeton.

### Professional Experience:

2003-2007 – ioIMAGE (20% employment): Head of Special Projects.

Invented and analyzed algorithms used by Intelligent Video Appliances.

2001-2003 – ioIMAGE: Head of Algorithms Team.

Created company's Video Threat Detection Core-Technology. Invented and implemented numerous image-processing, statistical-analysis and learning algorithms.

1995-2000 – Military Service: Senior Academic Officer in the Intelligence Corp.

### Research Interests:

Isoperimetric, functional and concentration inequalities on weighted Riemannian manifolds, Bakry-Émery and Lott-Sturm-Villani Curvature-Dimension condition, generalized Ricci Curvature, diffusion semi-group and heat-kernel estimates, convexity of solutions to elliptic and parabolic PDE, Wasserstein space, Optimal Transport and the Monge-Ampère equation, Asymptotic Convex and Geometric Analysis, distribution of volume in convex bodies, metric entropy and covering numbers, phenomena in high dimension, convexity in Statistical Physics, geometry of isoperimetric minimizing surfaces, Geometric Measure Theory, classical Convex Geometry, “local theory” of Banach Spaces.

## Teaching Experience:

Undergraduate Courses:

Calculus, Probability, Real Analysis, Complex Functions, Introduction to Functional Analysis, Functional Analysis.

Graduate Courses:

*“Isoperimetric Inequalities, Concentration of Measure Phenomenon, Convexity, and their Applications”*, *“Convex Bodies in High Dimension”*, *“Isoperimetry, Sobolev and Concentration inequalities through the lens of Convexity”*, *“High-Dimensional Convex Geometric Analysis”*.

Fields Institute - semester long course on *“Isoperimetric Inequalities with applications to Asymptotic Geometric Analysis”* (organizer and lecturer).

Paris-Est – short-course on *“Isoperimetric Inequalities: Methods and Applications”*.

SMS, Montreal – mini-course on *“Isoperimetric and Concentration Inequalities”*.

HIM, Bonn - mini-course on *“1-D Localization”*.

## Departmental Activities at Technion's Mathematics Department:

2011-14 – member of Graduate Studies and Computing Committees.

2012-14 – co-organizer of Departmental Colloquium.

2014-present – member of Graduate Studies and Recruitment Committees.

## Public Professional Activities:

2016 – offered to join **BIRS** (Banff International Research Station) **Scientific Advisory Board**; postponed.

2016 - present – member of editorial board of *Journal of Functional Analysis*.

2015-16 – co-editor of Springer's Lecture Notes in Mathematics volume 2169 entitled "*Geometric Aspects of Functional Analysis - Israel Seminar (GAFA) 2014-2016*" (to appear).

2013-14 – co-editor of Springer's Lecture Notes in Mathematics volume 2116 entitled "*Geometric Aspects of Functional Analysis - Israel Seminar (GAFA) 2011-2013*".

2010-11 – co-editor of volume 545 of the AMS's *Contemporary Mathematics* journal, dedicated to *“Concentration, Functional Inequalities, and Isoperimetry”*.

2005-present – **selected refereeing**: *Advances In Mathematics*, *Annals of Probability*, *Annals of Mathematics*, *Compositio Mathematica*, *Crelle's Journal*, *Duke Mathematical Journal*, *Geometric and Functional Analysis*, *Geometry and Topology*, *Inventiones Mathematicae*, *Journal of Differential Geometry*, *Journal of the AMS*, *Journal of the EMS*, *Journal of Functional Analysis*, *Mathematics of Operations Research*, *Mathematische Annalen*, *Memoirs of the AMS*, *Probability Theory and Related Fields*.

## Awards:

2016 – Anna and Lajos Erdős Prize in Mathematics.

2013 – Cooper Award for Academic Excellence.

2011 – Bergmann Memorial Research Award of the Bi-national Science Foundation.

2010-2012 – Landau Fellowship of the Taub Foundation.

2010-2013 – Allon Fellowship.

2007 – Fulbright Post-Doctoral Scholar Award (declined).

2007 – The Gad Resheff Memorial Prize.

2007 – The Dr. Otto Schwarz Graduate Scholarship Fund Award.

During Military Service:

Served as “IDF Outstanding Student”.

Commendation for part in the Israel National Security Award.

## During Studies:

- Dean and Rector's lists at Tel-Aviv University and the Weizmann Institute.
- Undergraduate 4-year Scholarship under "Program for Distinguished Students".
- Shie Bleiman Award for High-School's final project in technology.

## Supervision:

- 2013-2014 - Laurent Veysseire, Post-Doc.
- 2015-2016 - Nikos Dafnis, Post-Doc.
  - 1-9/2017 - Piotr Nayar, Post-Doc.
- 2017-2018 - Mayukh Mukherjee, Post-Doc.
- 2014-present - Eran Calderon, PhD Student.

## Grants:

- 2010-2013 – Israel Science Foundation: "Generic Chaining in Asymptotic Geometric Analysis" (joint with Shahar Mendelson), ~238,000 USD.
- 2011 – German-Israeli Foundation's Young Scientist Program: "Isoperimetric Inequalities via Contracting Maps", 33,500 Euros.
- 2011-2014 – Bi-national Science Foundation: "The Hierarchy of Mass Concentration on Convex Bodies" (joint with Grigoris Paouris), 81,000 USD.
- 2012 – Israel Science Foundation Workshop Grant "Interactions between Asymptotic Geometric Analysis and Mathematical Physics" (joint with Shahar Mendelson), ~17,000 USD.
- 2012-2016 – European Commission's FP7 Career Integration Grant: "Isoperimetric and Concentration Inequalities in High-Dimensional Convex Spaces", 100,000 Euros.
- 2015-2020 - European Research Commission's Starting Grant: "High-Dimensional Convexity, Isoperimetry and Concentration via a Riemannian Vantage Point", 1,194,000 Euros.

## Publications<sup>1</sup>:

### Refereed Journal Papers (published):

1. E. Milman, "The semi-algebraic theory of stochastic games", *Math. Oper. Res.* 27, 401-418, 2002.
2. E. Milman, "Approachable sets of vector payoffs in stochastic games", *Games Econ. Behav.* 56, 135-147, 2006.
3. E. Milman, "Dual mixed volumes and the Slicing Problem", *Adv. Math.* 207 (2), 566-598, 2006.
4. E. Milman, "Generalized Intersection Bodies", *J. Func. Anal.* 240 (2), 530-567, 2006.
5. E. Milman, "A comment on the low-dimensional Busemann-Petty problem", Lecture Notes in Math. 1910, *GAFSA Seminar Notes 2004-5*, 245-253, 2007.
6. E. Milman, "A remark on two duality relations", *Integr. Equ. Oper. Theory* 57 (2), 217-228, 2007.
7. B. Klartag and E. Milman, "On volume distribution in 2-convex bodies", *Israel J. Math.* 164, 221-249, 2008.
8. E. Milman and S. Sodin, "An isoperimetric inequality for uniformly log-concave measures and uniformly convex bodies", *J. Func. Anal.* 254 (5), 1235-1268, 2008.
9. E. Milman, "Generalized Intersection Bodies are not equivalent", *Adv. Math.* 217 (6), 2822-2840, 2008.
10. E. Milman, "Uniform tail-decay of Lipschitz functions implies a linear isoperimetric inequality under convexity assumptions", *C. R. Math. Acad. Sci. Paris* 346, 989-994, 2008.
11. E. Milman, "On Gaussian marginals of uniformly convex bodies", *J. Theor. Probab.* 22 (1), 256-278, 2009.

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<sup>1</sup> Electronic copies available at [tx.technion.ac.il/~emilman](http://tx.technion.ac.il/~emilman). All authors ordered alphabetically.

12. E. Milman, “On the role of convexity in isoperimetry, spectral-gap and concentration”, *Invent. Math.* 177 (1), 1-43, 2009.
13. E. Milman, “On the role of convexity in functional and isoperimetric inequalities”, *Proc. London Math. Soc.* 99 (3), 32-66, 2009.
14. E. Milman, “Concentration and isoperimetry are equivalent assuming curvature lower bound”, *C. R. Math. Acad. Sci. Paris* 347, 73-76, 2009.
15. E. Milman, “Isoperimetric and concentration inequalities - equivalence under curvature lower bound”, *Duke Math. J.* 154 (2), 207-239, 2010.
16. E. Milman, “Isoperimetric bounds on convex manifolds”, Concentration, Functional Inequalities and Isoperimetry, *Contemp. Math.* 545, Amer. Math. Soc., 195-208, 2011.
17. O. Guédon and E. Milman, “Interpolating thin-shell and sharp large-deviation estimates for isotropic log-concave measures”, *Geom. Funct. Anal.* 21 (5), 1043-1068, 2011.
18. B. Klartag and E. Milman, “Centroid Bodies and the logarithmic Laplace Transform – a Unified Approach”, *J. Func. Anal.* 262 (1), 10-34, 2012.
19. E. Milman, “Properties of isoperimetric, functional and transport-entropy inequalities via concentration”, 29 pages, *Prob. Theor. Rel. Fields* 152, 475–507, 2012.
20. Y.-H. Kim and E. Milman, “A generalization of Caffarelli's contraction theorem via (reverse) heat flow”, *Math. Annal.* 354 (3), 827-862, 2012.
21. B. Klartag and E. Milman, “Inner Regularization of Log-Concave Measures and Small-Ball Estimates”, Lecture Notes in Math. 2050, *GFA Seminar Notes* 2006–2010, 267-278, 2012.
22. E. Milman, “Model Spaces for Sharp Isoperimetric Inequalities”, *C. R. Math. Acad. Sci. Paris* 350, 897-902, 2012.
23. F. Barthe and E. Milman, “Transference Principles for Log-Sobolev and Spectral-Gap with Applications to Conservative Spin Systems”, *Comm. Math. Physics* 323, 575-625, 2013.
24. E. Milman and L. Rotem, “Complemented Brunn-Minkowski Inequalities and Isoperimetry for Homogeneous and Non-Homogeneous Measures”, *Adv. Math.* 262, 867-908, 2014.
25. A. Giannopoulos and E. Milman, “M-estimates for isotropic convex bodies and their Lq-centroid bodies”, Lecture Notes in Math. 2116, *GFA Seminar Notes* 2011–2013, 159-182, 2014.
26. A. Kolesnikov and E. Milman, “Remarks on the KLS Conjecture and Hardy-Type Inequalities” Lecture Notes in Math. 2116, *GFA Seminar Notes* 2011–2013, 159-182, 2014.
27. E. Milman, “Sharp Isoperimetric Inequalities and Model Spaces for Curvature-Dimension-Diameter Condition”, *J. Eur. Math. Soc.* 17 (5), 1041–1078, 2015.
28. E. Milman, “On the mean-width of isotropic convex bodies and their associated Lp-centroid bodies”, 16 pages, to appear in *Inter. Math. Res. Notices*.
29. A. Kolesnikov and E. Milman, “Isoperimetric Inequalities on Weighted Manifolds with Boundary”, *Doklady Akademii Nauk* 464 (2), 136–140, 2015 (in Russian).
30. E. Milman, “Beyond traditional Curvature-Dimension I: new model spaces for isoperimetric and concentration inequalities in negative dimension”, 38 pages, to appear in *Trans. Amer. Math. Soc.*
31. E. Milman, “Harmonic Measures on the Sphere via Curvature-Dimension”, 11 pages, to appear in *Annales de la Faculté des Sciences de Toulouse*.
32. A. Kolesnikov and E. Milman, “Riemannian metrics on convex sets with applications to Poincaré and log-Sobolev inequalities”, 46 pages, to appear in *Calc. Var. & PDE*.
33. A. Kolesnikov and E. Milman, “Sharp Poincaré-type inequality for the Gaussian measure on the boundary of convex sets”, 14 pages, to appear in *GFA Seminar Notes*.
34. A. Kolesnikov and E. Milman, “Brascamp–Lieb type inequalities on weighted Riemannian manifolds with boundary”, 24 pages, to appear in *J. Geom. Anal.*
35. E. Milman, “Spectral Estimates, Contractions and Hypercontractivity”, 38 pages, to appear in *J. Spectral Theory*.

#### Refereed Journal Papers (submitted):

36. A. Kolesnikov and E. Milman, “Poincaré and Brunn–Minkowski inequalities on the boundary of weighted Riemannian manifolds”, 42 pages, submitted.
37. S. Mendelson, E. Milman and G. Paouris, “Generalized Sudakov via Dimension Reduction - A Program”, 44 pages, submitted.
38. A. Kolesnikov and E. Milman, “The KLS Isoperimetric Conjecture for Generalized Orlicz Balls”, 36 pages, submitted.

#### In Collection (Review paper with additional original results):

39. E. Milman, “A converse to the Maz'ya inequality for capacities under curvature lower Bound”, *Springer's International Mathematical Series* Vol. 11, *Around the Research of Vladimir Maz'ya* I. Function Spaces, 321-348, 2010.

#### Refereed papers in Conference Proceedings:

40. E. Milman, “A proof of Bobkov's Spectral Bound for Convex Domains via Gaussian Fitting and Free Energy Estimation”, Centre de Recherches Mathématiques, *CRM Proceedings and Lecture Notes*, Vol. 56, 181-196, 2013.

#### Finalized Manuscript:

41. F. Cavalletti and E. Milman, “The globalization theorem for the Curvature-Dimension condition”, 108 pages, <https://arxiv.org/abs/1612.07623>, to be submitted.

#### **Talks:**

##### Plenary and Invited Talks in Conferences:

- Oct 2016, Plenary Talk, Workshop on “Analytic Aspects of Convexity”, Rome.
- Sep 2016, Plenary Talk, “Barcelona Analysis Conference 2016”.
- Jun 2016, Plenary Talk, Conference on “Analysis, Geometry, and Optimal Transport”, Korea IAS (could not attend).
- Jun 2016, Erdos Prize talk, Israeli Mathematical Union annual meeting, Dead Sea.
- May 2016, Joram Memorial Seminar on “Ricci Flow and Geometrization”, Hebrew University.
- Feb 2016, Workshop on “Asymptotic Geometric Analysis”, Oberwolfach.
- Nov 2015, Conference on “Analytic and Probabilistic Techniques in Modern Convex Geometry”, Missouri.
- Oct 2015, Conference on “Convexity, Probability and Discrete Structures, a Geometric Viewpoint”, Paris-Est.
- Apr 2015, Workshop on "Information Theory and Concentration Phenomena", IMA, Minneapolis.
- Feb 2015, Mini-Course, Workshop on "New developments in Optimal Transport, Geometry and Analysis", HIM, Bonn.
- Dec 2014, Conference in Honour of the 60th Birthday of Dominique Bakry, Toulouse.
- Sep 2014, Workshop on “Geometry and Probability”, Kyoto.
- Jun 2014, Workshop on “Isoperimetric problems between Analysis and Geometry”, Pisa.
- Apr 2014, Workshop on “Functional Inequalities”, Toulouse.
- June 2013, Israeli Mathematical Union annual meeting, Haifa University.
- May 2013, Conference on “Banach Spaces: Geometry and Analysis”, Hebrew University.
- May 2013, Conference on “Complex Analysis and Dynamical Systems VI”, Naharyia.
- May 2013, Workshop on "Heat Kernels, Stochastic Processes and Functional Inequalities", Oberwolfach.

- Dec 2012, Plenary Talk, Workshop on “Convex Geometry and its Applications”, Oberwolfach.
- Nov 2012, ERC Workshop on “Optimal Transport and Applications”, Pisa.
- Sep 2012, Conference on “Convex Geometric Analysis”, Heraklion.
- Jun 2012, Conference on “Phenomena in high dimensions in geometric analysis, random matrices, and computational geometry”, Roscoff.
- May 2012, Conference on “Interactions between Asymptotic Geometric Analysis and Mathematical Physics”, Eilat and Technion.
- Jan 2012, Plenary Talk, “Concentration inequalities and their applications”, CIRM, Luminy.
- Aug 2011, Plenary Talk, “Introductory workshop on quantitative geometry”, MSRI (did not attend due to personal reasons).
- Jul 2011, Mini-Course in Séminaire de Mathématiques Supérieures 2011 on “Metric Measure Spaces: Geometric and Analytic Aspects”, Montreal.
- Apr 2011, Conference on “Asymptotic Geometric Analysis and Convexity”, Israel.
- Jan 2011, Plenary Talk / Short Course in workshop on “Functional Inequalities and Discrete Spaces”, Université Paris-Est.
- Nov 2010, Workshop on “Optimal Transport and Geometric Probability”, Fields Institute.
- Sep 2010, Plenary Talk, Workshop on “Asymptotic Geometric Analysis”, Fields Institute.
- Sep 2010, SAGE Workshop on “Optimal Transport and Riemannian Geometry”, UT Austin.
- Aug 2010, ICM Satellite Conference on “Probability and Stochastic Processes”, Bangalore (did not attend due to personal reasons).
- Aug 2010, Plenary Talk, Conference on “Perspectives in High Dimensions”, CWRU, Cleveland.
- Jul 2010, Conference on “Asymptotic Geometric Analysis”, EIMI, St. Petersburg.
- Mar 2010, Workshop on “Volume Inequalities”, Banff.
- Jun 2009, Conference on “State of Geometry and Functional Analysis”, Tel-Aviv University.
- Jun 2008, Fourth annual conference on “Phenomena in High Dimensions”, Sevilla.
- May 2008, Fifth Conference on “Probability in High Dimensions”, CIRM, Luminy.
- Mar 2008, Plenary Talk, Conference on “Asymptotic Convex Geometry”, University of Missouri.
- Nov 2007, Workshop on “Algorithmic Convex Geometry”, AIM, Palo-Alto.
- Sep 2007, Workshop on “Geometrization of Probability”, Fields Institute, Ottawa.
- Aug 2007, Workshop on “Fourier Analytic Methods in Convex Geometry”, AIM, Palo-Alto.
- Jun 2007, Third annual conference on “Phenomena in High Dimensions”, Samos.
- Jun 2007, Workshop on “Convex Geometry - Analytic aspects”, Cortona.
- May 2007, Israel Mathematical Union annual meeting, Ben-Gurion University.
- Sep 2006, Workshop on “Convexity and Probability”, Freudenstadt.
- Jun 2006, Second annual conference on “Phenomena in High Dimensions”, IHP, Paris.
- Jul 2005, First annual conference on “Phenomena in High Dimensions”, TU Vienna.

#### Colloquium talks:

- Nov 2015, Tel-Aviv University.
- May 2015, Ben-Gurion University.
- May 2015, Hebrew University.
- May 2011, Ben-Gurion University.
- May 2011, Tel-Aviv University.
- Apr 2009, Lehigh University.
- Dec 2008, Polytechnic Institute of NYU.
- Jun 2008, Technion - I.I.T.
- May 2008, Case Western University.
- Nov 2008, Polytechnic University of NY.

Other:

Many further invitations to give seminars both in Israel and abroad, including the Institute for Advanced Study, Institute for Pure and Applied Mathematics, Isaac Newton Institute, Hausdorff Institute of Mathematics, Max-Planck-Institut für Gravitationsphysik (Albert-Einstein-Institut), NYU, MIT.

**Conferences Organized:**

2009 – co-organizer of international conference on “*Concentration, Functional Inequalities, and Isoperimetry*” in Florida, including a Special Session of the AMS 2009 Fall Southeastern Meeting with same title.

2012 – co-organizer of ISF workshop and international conference on “*Interactions between Asymptotic Geometric Analysis and Mathematical Physics*”, Technion and Eilat.

2017 – co-organizer of MSRI workshop on “Geometric functional analysis and applications”.