

Curriculum Vitae

Mikhail Lyubich

September 20, 2022

Date of birth: February 25, 1959.

Education

MS 1980, Kharkov State University. Thesis: “Entropy of rational maps”.

PhD 1984, Tashkent State University. Thesis: “Dynamics of rational maps”.

Main field of interest:

Analytic Low-Dimensional Dynamics, complex and real.

Positions:

Institute for Math. Sciences and Math. Dept. at Stony Brook
(Feb 1990 – Assistant Professor, Sept 1990 – Associate Professor,
Sept 1994 – Professor)

Sept 1995 – 2004: Deputy Director of the IMS

2002 – 2007: Professor and Canada Research Chair
at the University of Toronto

Sept 2004 – 2007: Co-Director of the IMS

Sept 2013 – 2016: Chair of Stony Brook Math Dept

Sept 2007 – current: Director of the IMS

2017: SUNY Distinguished Professor

Memberships

- Member of the St Petersburg and American Math Societies
- Fellow of the American Math Society (Inaugural Class)
- Member of the Brazilian and EU Academies of Sciences
- Member of the American Academy of Arts and Sciences.
- Member of the National Academy of Sciences.

Honors and Awards

Prize of Leningrad Math. Society 1987

Alfred P. Sloan Research Fellowship 1991-1994

NSF grants 1991-2019

NSERC grant 2003-2008

Guggenheim Fellowship, 2002 - 2004

Jeffery-Williams prize of the Canadian Math. Society 2010

Fellowship of the Hagler Institute for Advanced Studies, 2019–2021.
Conference “Analytic Low-Dimensional Dynamics”, Fields Institute, Toronto,
May–June 2019, followed by two special issues of the *Arnold Math. J.*
(v.6, # 3–4 (2020) and v.8, # 2 (2022)).
Clay Senior Scholarship at MSRI (spring 2022).

Selected invited lectures

- Plenary address at the ICM-14, Seoul (2014)
- Invited address at ICM-94, Zürich (1994)
- Plenary address at the V Latin American Congress of Mathematicians, Barranquilla (2016)
- Invited address at the International Congress in Mathematical Physics, London (July 2000)
- Invited address at the First Latin American Congress of Mathematicians, IMPA (July 2000)
- Plenary address at the annual AMS meeting in Washington, DC (Jan 2000)
- Plenary address at the joint meeting of FSM and CMS, Toulouse (July 2004)
- Plenary address at the annual CMS meeting in Ottawa (Dec 2013)
- Jeffery-Williams Prize lecture at the Meeting of the Canadian Math Society, June 2010
- Series of Balzan-Palis Symposia at IMPA (Rio de Janeiro) and IHP (Paris), 2012–2015
- Invited speaker at birthday conferences for Bodil Branner (Holbaek 2003), Eric Bedford (Bloomington 2008), Pavel Bleher (Amherst 2017), Leonid Bunimovich (Banff 2009 and Amherst 2017), Robert Devaney (Tossa de Mar 2008), Adrien Douady (Paris 1995 and 2006), John Hubbard (Paris 2005 and Bremen 2015), Yulij Ilyashenko (Moscow 2014), Linda Keen (CUNY 2010), Keith Burns (Provo 2017), Yuri Lyubich (Technion 2006), Nick Makarov (Saas Fee 2016), Wellington de Melo (Salvador 2006 and Rio 2016), John Mather (Princeton 2002), John Milnor (Stony Brook 1991 and Cancun 2016), Jacob Palis (IMPA 2000 and Buzios 2011), Dennis Sullivan (New York 2002), Oleg Viro (Stockholm 2008), Alberto Verjovsky (Cuernavaca 2003 and 2013), and Misha Zaigenberg (Grenoble 2016);
at memorial conferences for B.Ya. Levin (Tel-Aviv 2008), Yoccoz (Paris 2017) and A. Douady (Paris 2007);
and at the Lyapunov’s 150th anniversary conference (Kharkov 2007).
Magna Conference: A Century of Science: Paving a Better Future, celebrating 100 years of the Brazilian Academy of Sciences, Rio de Janeiro (May 2016).
at the Fields Medal Symposium in honor of Artur Avila, Fields Institute, Toronto, November 2019.
Texas Geometry and Topology Conference, Nov 2019.
One World Dynamics seminar (online), Oct, 2020.
Dynamics day in Cuernavaca dedicated to Peter Makienko’s 60th birthday,

Dec. 2020.

Renormalization Retrospective: Feigenbaum Memorial Conference, SCGP and IMS, March 2021.

Indian Math Consortium Distinguished Lecture Series (online), June 2021.

Lecture series

- European Math. Society Lecture Series “Real and Complex Dynamics”, St. Petersburg - Barcelona - Copenhagen (May - June 1999)
- Annual Spring Lecture Series “Complex Dynamics”, University of Arkansas (April 1999) (joint with J. Milnor).
- Lecture series on the Real and Complex Dynamics in Kyoto - Hiroshima - Tokyo (June 2000).
- Mini-course on “Laminations and Holomorphic Dynamics” at the International Conference “New Directions in Dynamical Systems”, Kyoto 2002.
- Workshop on Dynamical Systems, Trieste (August 2001). Mini-course on the Regular and Stochastic Dynamics in the real quadratic family.
- Winter School “Recent Trends in Non-linear Dynamics”, Cullera, Spain (Jan 2008). Mini-course “Introduction to Holomorphic Dynamics”.
- Winter school in Complex Analysis and Geometry (Toulouse, Jan 2010). Mini-course “Lee-Yang zeros and 2D rational dynamics ”.
- Workshop “Discrete groups in complex geometry”, Trieste (July 2010). Mini-course “On the problem of local connectivity of the Mandelbrot set”
- Conference “Geometric and Algebraic Structures in Mathematics” to celebrate Dennis Sullivan 70th birthday, Stony Brook (May 2011). Mini-course on Renormalization.
- Workshop “MLC, Status and Quo Vadis?”, Holbaek (Denmark), Sept 2012. Mini-course “A priori bounds” (joint with J. Kahn).
- Advanced School and Workshop in Real and Complex Dynamics, Trieste, May 2013. Mini-course on Complex 1D Dynamics.
- Workshop “Global Dynamics Beyond Uniform Hyperbolicity”, Provo (Utah), June 2017. Mini-course “Dynamics of the dissipative complex Henon maps” (joint with E. Bedford).

Math community service and outreach

Over the years, I have been serving as a nominator or a referee for various prize committees, including the Fields medal, the Abel, Wolff, Balzan, TWAS, European Math Society, and AMS Satter prizes, and as a member of the Nemmers prize committee. I have been also regularly serving for various US, Canadian, European, Israeli, and Brasileian grants and fellowships agencies, and as a referee for the Annals and Inventiones Math., JAMS and JEMS, Duke and GAFA, Publications IHES and Annales ENS, and many other journals,

I was serving on the Committee designing the Simons Center for Geometry and Physics in Stony Brook.

As the IMS Director, I was participating in launching a new journal, “Arnold Mathematical Journal” (owned by the IMS in cooperation with Springer).

I was also serving on the boards of the “Electronic J. of Conformal Geometry and Dynamics”, “Mathematical Physics, Analysis and Geometry”, “Ergodic Theory and Dynamical Systems”, “Discrete and Continuous Dynamics”, and “Communications for Math. Physics”.

I have co-organized 4 Scientific Programs:

- Holomorphic Dynamics and Hyperbolic Geometry, MSRI (Spring 1995),
- Program at the Fields Institute in Toronto “Renormalization in Dynamics and Math. Physics” (fall 2005).
- Program at the Fields Institute in Toronto “Holomorphic Dynamics, Hyperbolic Geometry, and Laminations” (spring 2006). Proceeding: Fields Institute Communications, v. 51. (with G. Forni, C. Pugh and M. Shub). and v. 53, dedicated to John Milnor’s 75th birthday (with M. Yampolsky)
- “Renormalization and Universality in Conformal Geometry, Dynamics, Random Processes and Field Theory”, Simons Center, February 2020 – May 2021 (held online during the pandemic).

I have also co-organized a dozen of Conferences and Workshops, including:

- “Laminations and foliations in dynamics, geometry and topology”, Stony Brook (May 1998); Proceedings: Contemporary Mathematics, v. 269 (with Y. Minsky and J. Milnor).
- “Graphs and patterns in mathematics and theoretical physics” in honor of Dennis Sullivan’s 60th birthday, Stony Brook (June 2001). AMS Proceedings of Symposia in Pure Math, v. 73 (with L. Takhtajan).
- “Advances in Low Dimensional Dynamics”, Stony Brook (June 2009);
- “Frontiers in Complex Dynamics”, in celebration of John Milnor’s 80th birthday, Banff (Feb 2011). Proceedings: Princeton Univ. Press, v. 51 (with A. Bonifant and S. Sutherland).
- “Geometric and Algebraic Structures in Mathematics”, dedicated to Dennis Sullivan’s 70th birthday, Stony Brook (June 2011). Proceedings: Pure and Applied Math. Quarterly, v. 9, # 2 (with L. Ji, C. McMullen and S.-T. Yau).
- “IMS-XXV”, to celebrate 25th anniversary of the IMS, Stony Brook (May 2015).
- Renormalization Retrospective: Feigenbaum Memorial Conference (March 2021).
- Many Faces of Renormalization (March 2021).

I have also co-organized a number of special sessions at the AMS, FSM and CMS meetings,

I have been also serving on the Scientific Committees for a number of other conferences, most recently:

- ‘Analysis, Geometry, and Probability’ Workshop in honor of Bishop’s 60th birthday, Simons Center, Stony Brook, March 2020.
- “Complex Dynamics” Conference, Luminy, Jan 2020.
- “Advancing Bridges in Complex Dynamics”, Luminy, September 2021.
- “Adventurous Berkeley Complex Dynamics”, MSRI, May 2021.

I also gave several lectures and mini-courses for high school students in the summer Sigma-camps (2017–2019) and in the Ward Melwill High School (June 2021), on the Mandelbrot set, chaos, fractals, and symmetries & geometry.

Training of students and postdocs

I have advised 13 PhD students, among them are M. Yampolsky, A. Benini, C. Cabrera, D. Cheraghi, T. Clark, and M. Dannenberg. Currently I am advising two PhD students in Stony Brook and co-advising a PhD student from Texas A&M.

Over the past twenty five years, I have been actively involved in working with postdocs and junior visitors of the IMS at Stony Brook and the University of Toronto (two-three people every year). The list of these people includes A. Avila, P. Berger, S. Brooks, A. de Carvalho, A. Cheritat, N.-B. Dang, A. Dudko, D. Dudko, T. Firsova, T. Gauthier, J. Kahn, L. Lomonaco, R. Lodge, M. Martens, Y. Minsky, S. Mukherjee, H. Peters, L. Rempe, J. Robertson, R. Roeder, N. Selinger, D. Smania, E. Vargas, and B. Weiss.

Selected publications (out of about 100 articles)

Dynamics in the quadratic and quasi-quadratic families

- Almost every real quadratic map is either regular or stochastic. *Annals of Math.*, v. 156 (2002), 1–78.
- (with A. Avila & W. de Melo) Regular or stochastic dynamics in real analytic families of unimodal maps. *Inventiones Math.*, v. 154 (2003), 451 – 550.
- Feigenbaum-Couillet-Tresser Universality and Milnor’s Hairiness Conjecture. *Annals of Math.*, v. 149 (1999), 319–420.
- Dynamics of quadratic polynomials, I-II. *Acta Math.*, v. 178 (1997), 185–297.
- Dynamics of quadratic polynomials, III. Parapuzzle and SBR measures. *Asterisque*, v. 261 (2000), 173–200. *Colloque en l’honneur d’Adrien Douady* (Orsay 1995).
- (with J. Milnor) The Fibonacci unimodal map. *JAMS*, v. 6 (1993), 425–457.
- Combinatorics, geometry and attractors of quasi-quadratic maps. *Annals of Math.*, v. 140 (1994), 347–404.

- (with M. Yampolsky) Complex bounds for real maps. *Ann. Inst. Fourier.*, v. 47 (1997), 1219–1255.
- (with D. Dudko and N. Selinger) Pacman renormalization and self-similarity of the Mandelbrot set near Siegel parameters. Preprint IMS at Stony Brook, # 4 (2017). *JAMS*, v. 33 (2020), 653–733.
- (with D. Dudko) Local connectivity of the Mandelbrot set at some satellite parameters of bounded type. arXiv:1808.10425.

Entropy and Stability

- Entropy properties of rational endomorphisms of the Riemann sphere. *Erg. Th. & Dyn. Syst.*, v. 3 (1983), 351–385.
- Some typical properties of the dynamics of rational maps, *Russian Math. Surveys*, v. 38 (1983), 154–155. Detailed account: An analysis of stability of the dynamics of rational functions. *Teoriya Funk., Funk. Anal. & Prilozh.*, # 42 (1984), 72 - 91 (Russian). English translation: *Selecta Mathematica Sovietica*, v. 9 (1990), 69 - 90.

Transcendental Dynamics

- (with A. Eremenko) Iterations of entire functions. *Dokl. Akad. Nauk SSSR*, v. 279 (1984), 25–27.
- (with A. Eremenko) Dynamical properties of some classes of entire functions. *Ann. Inst. Fourier*, v. 42 (1992), # 4, 989–1020.
- (with A. Eremenko) Examples of entire functions with pathological dynamics. *J. London Math. Soc.*, v. 36 (1987), 458–468.
- Measurable dynamics of the exponential. *Siberian J. of Math.*, v. 28 (1987), 111–127.
- (with Anna Benini) Repelling periodic orbits and landing rays for post-singular bounded exponential maps. *Ann. Inst Fourier*, v. 64 (2014), 1493–1520.

Smooth 1D Dynamics

- Non-existence of wandering intervals and structure of topological attractors of one-dimensional dynamical systems, I. The case of negative Schwarzian derivative. *Erg. Th. & Dyn. Syst.*, v. 9 (1989), 737–750.
- (with A. Blokh) Attractors of transformations of the interval. *Function. Analysis and Appl.*, v. 21 (1987), 70–71. Detailed account: Attractors of maps of the interval. *Banach Center Publ.*, v. 23 (1989), 427–442.
- (with A. Blokh) Measure of solenoidal attractors of unimodal transformations of the interval. *Math. Notes*, v. 48 (1990), 15–20.
- (with A. Blokh) Measurable dynamics of S -unimodal maps of the interval. *Ann. Sci. Ec. Norm Sup.*, v. 24 (1991), 545–573.

Towards MLC

- (with J. Kahn) Quasi-Additivity Law in conformal geometry. *Annals of Math.*, v. 169 (2009), 561–593.
- (with J. Kahn) A priori bounds for some infinitely renormalizable quadratics, II. Decorations. *Ann. Sci. Ecole Norm. Sup.*, v. 41 (2008), 57–84.

Higher degree unicritical dynamics

- (with J. Kahn) Local connectivity of Julia sets for unicritical polynomials. *Annals of Math.*, v. 170 (2009).
- (with A. Avila, J. Kahn and W. Shen) Combinatorial rigidity for unicritical polynomials. *Annals of Math.*, v. 170 (2009).
- (with A. Avila and W. Shen) Parapuzzle of the Multibrot set and typical dynamics of unimodal maps. *J. European Math Soc.*, v. 13 (2011), 27–56.
- (with A. Avila) The full renormalization horseshoe for unimodal maps of higher degree: exponential contraction along hybrid classes. *Publications IHES*, n 114 (2012), p. 171–223.

Complex Hénon family

- (with E. Bedford & J. Smillie) Polynomial diffeomorphisms of \mathbf{C}^2 , IV: The measure of maximal entropy and laminar currents. *Inventiones Math.*, v. 112 (1993), 77–125.
- (with E. Bedford & J. Smillie) Distribution of periodic points of polynomial diffeomorphisms of \mathbf{C}^2 . *Inventiones Math.* (1994).
- (with Romain Dujardin) Stability and bifurcations for dissipative polynomial automorphisms of \mathbf{C}^2 . *Inventiones Math.*, v. 200 (2015), 439–511
- (with H. Peters) Classification of invariant Fatou components for dissipative Hénon maps. *GAFA*, v. 24 (2014), 887–915.
- (with H. Peters) Structure of partially hyperbolic Hénon maps. *J. European Math. Soc.*, v. 23 (2021), 3075–3128.
- (with T. Firsova, R. Radu and R. Tanase) Hedgehogs for neutral dissipative germs of holomorphic diffeomorphisms of \mathbf{C}^2 . Preprint IMS at Stony Brook, # 2 (2016). To appear in Asterisque’s J.-C. Yoccoz meomorial issue.
- (with R. Radu and R. Tanase) Hedgehogs in higher dimensions and their applications. Preprint IMS at Stony Brook, # 3 (2016). To appear in Asterisque’s J.-C. Yoccoz meomorial issue.

Real Hénon family

- (with A. de Carvalho and M. Martens) Renormalization in the Hénon family, I. Universality but non-rigidity. *J. Stat.Phys.*, Special issue dedicated to Feigenbaum’s 60th birthday, v. 121 (2005), 611–669.
- (with Marco Martens) Renormalization in the Hénon family, II: the heteroclinic web. *Inventiones Math.*, v. 186 (2011), 115–189.
- (with Marco Martens) Probabilistic universality in two-dimensional dynamics. Preprint IMS at Stony Brook, # 2 (2011).

Laminations in Holomorphic Dynamics

- (with Y. Minsky) Laminations in holomorphic dynamics. *J. Diff. Geometry.*, v. 47 (1997), 17–94.
- (with Vadim Kaimanovich) Conformal and harmonic measures on laminations associated with rational maps. *Memoirs of the AMS*, v. 173 (2005), # 820.

Dynamics and Stat Physics

- (with Pavel Bleher) The Julia sets and complex singularities in hierarchical Ising models. *Comm. Math. Phys.*, v. 141 (1991), 453-474.
- (with P. Bleher and R. Roeder) Lee-Yang zeros for the Diamond Hierarchical Lattice and 2D rational dynamics, I. Foliation of the physical cylinder. *Journal des Mathématiques Pures et Appliquées (Liouville Journal)*, v. 107 (2017), 491–590.
- (with P. Bleher and R. Roeder) Lee-Yang zeros for the Diamond Hierarchical Lattice and 2D rational dynamics, II: Global pluripotential interpretation. *J. of Geometric Analysis*, v. 30 (2020), 777–833.

Geometry of Julia sets

- Typical behavior of trajectories of a rational mapping of the sphere. *Dokl. Akad. Nauk SSSR*, v. 268 (1982), 29 - 32.
- On the Lebesgue measure of the Julia set of a quadratic polynomial. Preprint IMS at Stony Brook, # 1991/10.
- (with A. Avila) Hausdorff dimension and conformal measures of Feigenbaum Julia sets. *JAMS*, 21 (2008), 305–383.
- (with A. Avila) Lebesgue measure of Feigenbaum Julia sets. arXiv: 1504.02986 (2015).
- (with M. Bonk and S. Merenkov) Quasisymmetries of Sierpinski carpet Julia sets. *Advances in Mathematics*, v. 180 (2016).
- (with S. Merenkov) Quasisymmetries of the basilica and the Thompson group. *GAFA*, v.28 (2018), 727–754.
- (with R. Lodge, S. Merenkov, and S. Mukherjee) On dynamical gaskets generated by rational maps, Kleinian groups, and Schwarz reflections. arXiv:1912.13438 (2019).
- (with S. Merenkov, S. Mukherjee, and D. Ntalampekos) David extension of circle homeomorphisms: welding, mating, and removability. arXiv:2010.11256 (2020).

Dynamics of Schwarz reflections

- (with S.-Y. Lee, N. Makarov, and S. Mukherjee) Dynamics of Schwarz reflections: the mating phenomena. arXiv:1811.04979 (2018).
- (with S.-Y. Lee, N. Makarov and S. Mukherjee) Dynamics of Schwarz reflections and tricorn. arXiv (2019).
- (joint with S.-Y. Lee, N. Makarov, and S. Mukherjee) Schwarz reflections and anti-holomorphic correspondences. *Advances in Math.*, v. 385 (2021).

Spectral Theory of Self-Similar groups

- (joint with N.-B. Dang and R. Grigorchuk) Self-similar groups and holomorphic dynamics: renormalization, integrability, and spectrum. arXiv:2010.00675 (2020).

Surveys and books

- Dynamics of rational transforms: topological picture. *Russian Math. Surveys*, v. 41 (1986), 43-117.

- (with A. Eremenko) Dynamics of analytic transformations. *Algebra & Analysis*. v. 1 (1989), 1–70.
- Forty years of unimodal dynamics: on the occasion of Artur Avila winning the Brin prize. *J. of Modern Dynamics.*, v. 6, no 2 (2012).
- Analytic low-dimensional dynamics: from dimension one to two. *Proceedings of the ICM-14*, v. I, 443–474 (2015).
- *Conformal Geometry and Dynamics of Quadratic Polynomials*, vol I-II. Book in preparation, 700 pp.