CURRICULUM VITAE ABREVIADO (CVA)

Part A. PERSONAL INFORMATION

First name	Kostiantyn		
Family name	Drach		
Gender	Male	Birth date (dd/mm/yyyy)	06.04.1990
Social Security, Passport, ID number	FP355992, NIE: Z0924138A		
e-mail	kostiantyn.drach@ub.edu	URL Web	https://sites.google.com/view/kdrach
Open Researcher and Contributor ID (ORCID)		0000-0002-9156-8616	

A.1. Current position

Position	Professor Lector		
Initial date	20.09.2023		
Institution	Universitat de Barcelona		
Department/Center	Departament de Matemàtiques i Informàtica	Facultat de Matemàtiques i Informàtica	
Country	Spain	Tel. number	(+34) 666671809
Key words	Dynamical systems, complex dynamics, rigidity, renormalization, geodesic flows, Riemannian geometry, convex geometry, isoperimetric inequalities, topological data analysis.		

A.2. Previous positions (research activity interruptions, indicate total months)

Period	Position/Institution/Country/Interruption cause
2012-2016	Lecturer/V.N. Karazin Kharkiv National University/Ukraine
2016-2019	Postdoctoral Fellow/Jacobs University Bremen/Germany
2020-2021	Researcher (postdoc)/Aix-Marseille University/France
2021-2023	Postdoc (Kaloshin Group)/Institute of Science and Technology Austria/Austria

A.3. Education

PhD, Graduate	University	Year
PhD in Mathematics	B.I. Verkin Institute for Low Temperature Physics and Engineering of the National Academy of Sciences of Ukraine (Kharkiv/Ukraine)	2016
Master's in Mathematics and Teaching of Mathematics	V.N. Karazin Kharkiv National University (Kharkiv/Ukraine)	2012

Part B. CV SUMMARY *(max. 5000 characters, including spaces)*

I did my PhD in geometry in 2016 in Kharkiv/Ukraine under supervision of Prof. A. Borisenko. Before that, I got my bachelor and master degrees with distinction in mathematics and teaching of mathematics from Kharkiv University. During my studies in Ukraine, I was actively participating in various international events and have started independent collaborations with colleagues abroad. Parallel to my PhD studies, in 2012-2016 I was a full-time tenured lecturer at the Math Department of Kharkiv University.

In 2016-2023 I held three research postdocs in internationally recognized groups working in dynamical systems. The first two postdocs, at Jacobs University Bremen/Germany (2016-2019) and Aix-Marseille University/France (2020-2021), were within the project *HOLOGRAM: Holomorphic dynamics connecting geometry, root-finding, algebra* funded by the ERC Advanced Grant (PI D. Schleicher). Within this project, I was the leading researcher in one of the 4 themes (Theme A: Combinatorics and Rigidity of Rational Maps). A highlight of my research output within this project is the proof of rigidity for Newton maps of polynomials

of arbitrary degree. Such maps appear naturally in Newton's iterative root-finding method and, thanks in part to my results, they form the largest family of non-polynomial rational maps for which rigidity is now known. The flagship paper in this line of research was published in [1]. Another highlight output within the HOLOGRAM project is a conceptual re-development of the theory of box mappings. This theory is a state-of-the-art tool to study rigidity of multicritical maps and was set forth in my 92-page paper [2]. My third postdoc was IST Austria (2021-2023), where I was part of an ERC project *SPERIG: Spectral Rigidity and Integrability for Billiards and Geodesic Flows* (PI V. Kaloshin). With Prof. Kaloshin, we collaborated on questions in spectral rigidity of expanding circle maps and geodesic flows. I highlight that for my postdocs I have successfully added Dynamical Systems as a completely new, primary research field parallel to my PhD field of Geometry. I actively maintain research in the latter, a highlight here is a complete resolution of the reverse isoperimetric problem for lambda-concave bodies in Euclidean space of any dimension [4] and a recent progress on Borisenko's conjecture in dimension 3 (submitted, 2024).

Since September 2023, I am a Professor Lector at Universitat de Barcelona (Spain).

I published 17 papers (13 in JCR journals, 3 are published jointly with my bachelor/master students based on their theses under my supervision). I have 64 citations at MathSciNet and 206 citations in Google Scholar.

I have built an extensive network of international collaborators. I have ongoing projects in dynamics with several centers, including Aix-Marseille Univ. (D. Schleicher), Imperial College London (S. van Strien), Stony Brook Univ. (M. Lyubich, D. Dudko), U. of Zurich (J. Yang), ISTA (V. Kaloshin), TIFR Mumbai (S. Mukherjee). I am a PI on an AEI Grant PID2023-147252NB-I00 (2024-2027) and a co-PI of an A*Midex Foundation Grant AMX-22-IN1-50 (2024-2029) between Aix-Marseille Univ./France and Univ. Barcelona (2024-2029, jointly with D. Schleicher, N. Fagella).

Since 2012, I have participated in more than 40 international conferences (>10 with invited talks, most recently in July 2025) and is regularly invited for research visits and seminar talks. In May 2022, I gave an invited talk at the final conference of the special semester in complex dynamics at MSRI (Berkeley/US). I co-organized 5 major international events (a highlight is the "Topics in Complex Dynamics", June 2025/UB, 75 participants).

I have 7+ years of teaching experience (in Ukraine, Germany, Austria, Spain) and 4+ years of outreach experience (public lectures and TV appearances, mentoring of high school research projects, most recently, I supervised a research project at the Barcelona Introduction to Mathematical Research program, July 2025). I supervised 5 bachelor theses (4/Ukraine, 1/Germany; one of these is now a tenure-track professor at the Univ. of Waterloo), 2 master theses (1/Ukraine, 1/Spain), and currently I am supervising 1 master student (UB) and 2 PhD students (Imperial College London/UK, jointly with Prof. S. van Strien; and at Aix-Marseille University, within the A*Midex Grant). I am a referee for 20+ international math journals (incl. *Adv. Math*, *GAFA*, *Trans. AMS*).

Since 2016, I have been involved in a project in applied mathematics related to Topological Data Analysis in clinical trials. In this award-winning project, I am providing scientific leadership to a group of 6 applied mathematicians. This work is done in partnership with the clinical research organization *Intego Clinicals* (US/Poland/Costa Rica/Ukraine). Among several awards, with the project I won the Best Paper Award in the ML/AI Stream at the major industrial conference PHUSE US Connect (March 2025, Florida/US). Based on this project, I have 3 patents.

Part C. RELEVANT MERITS

C.1. Publications [selection of 10 most relevant]

1. K. Drach, D. Schleicher. Rigidity of Newton Dynamics. *Adv. Math.* 408 (2022) 108591. https://doi.org/10.1016/j.aim.2022.108591
2. T. Clark, K. Drach, O. Kozlovski, S. van Strien. The dynamics of complex box mappings. *Arnold Math. Journal* 8 (2022) 319-410. https://doi.org/10.1007/s40598-022-00200-7
3. K. Drach, R. Lodge, D. Schleicher, M. Sowinski. Puzzles and the Fatou-Shishikura injection for rational Newton maps. *Trans. Amer. Math. Soc.* 374 (2021), no. 4, 2753-2784. https://doi.org/10.1090/tran/8273

4. R. Chernov, K. Drach, K. Tatarko. A sausage body is a unique solution for a reverse isoperimetric problem. *Adv. Math.* 353 (2019), 431-445. https://doi.org/10.1016/j.aim.2019.07.005
5. K. Drach, Ya. Mikulich, J. Rückert, D. Schleicher. A combinatorial classification of postcritically fixed Newton maps. *Ergod. Theor. Dyn. Syst.* 39 (2019), no. 11, 2983-3014. https://doi.org/10.1017/etds.2018.2
6. K. Drach, Y. Haidamaka, M. Mixer, M. Skoryk. Archimedean toroidal maps and their minimal almost regular covers. *Ars Math. Contemp*. 17 (2019), no. 2, 493-514. https://doi.org/10.26493/1855-3974.1825.64c
7. K. Drach. Inradius estimates for convex domains in 2-dimensional Alexandrov spaces. *Anal. Geom. In Metric Spaces* 6 (2018), 165-173. https://doi.org/10.1515/agms-2018-0009
8. A. Borisenko, K. Drach. Extreme properties of curves with bounded curvature on a sphere. *J. Dyn. Contr. Syst.* 21 (2015), no. 3, 311-327. https://doi.org/10.1007/s10883-014-9221-z
9. K. Drach. Some sharp estimates for convex hypersurfaces of pinched normal curvature. *J. Math. Phys. Anal. Geom.* 11 (2015), no. 2, 111-122. https://doi.org/10.15407/mag11.02.111
10. K. Drach, M. Mixer. Minimal covers of equivelar toroidal maps. *Ars Math. Contemp.* 9 (2015), no. 2, 77-91. https://doi.org/10.26493/1855-3974.406.3ec

Key preprints:

11. K. Drach, L. Staresinic, S. van Strien. Density of Stable Interval Translation Maps. 2024, 75 pages, *submitted*. https://doi.org/10.48550/arXiv.2411.14312
12. K. Drach, K. Tatarko. Reverse isoperimetric problems under curvature constraints, 2023, 39 pages, *submitted*. https://doi.org/10.48550/arXiv.2303.02294

C.2. Congress (selection of 10)

1. May 2024, Parameter spaces in complex dynamics and related topics (**invited talk**), Pisa/Italy [link to recording]
2. July 2023, Dynamische Systeme (**invited talk**), Oberwolfach/Germany
3. March 2023, Complex dynamics: connections to other fields (**invited talk**), Chęciny/Poland (part of Thematic Research Program “Modern holomorphic dynamics and related fields”)
4. August 2022, Complexity of Julia sets IV (**invited talk**), Bedlewo/Poland.
5. May 2022, Adventurous Berkeley Complex Dynamics (**invited talk**), MSRI/USA.
6. October 2021, Complexity of Julia sets III (**invited talk**), Bedlewo/Poland, [link to recording].
7. September 2021, Advancing Bridges in Complex Dynamics (**invited talk**), CIRM/France, [link to recording].
8. April 2021, Topics in Complex Dynamics 2021 (**invited talk**), University of Barcelona, Barcelona/Spain, [link to recording].
9. June 2018, Hanseatic Dynamical Systems Day (**invited talk**), Hamburg University, Hamburg/Germany.
10. August 2014, International Congress of Mathematicians 2014 (**short communication**), Seoul/Korea.

C.3. Research projects

1. **PI**, Agencia Estatal de Investigación/Spain, Grant PID2023-147252NB-I00 “Wandering domains, rigidity, and root finding in holomorphic dynamics” **€ 100 000** (PI with N. Fagella (UB))
   Period: 01.09.2024-31.08.2027.
2. **Co-PI**, A*Midex Foundation “Modern Mathematics in Marseille and More” Grant # AMX-22-IN1-50, total budget **€ 987 388**, (co-PI with D. Schleicher (Aix-Marseille University/France), N. Fagella (Universitat de Barcelona/Spain)).
   Period: 01.09.2024-30.08.2029
3. **PI**, FFG Career Grant/Austria, Grant #41069370, total budget: **€2000**, period: 01.09.2021—31.12.2021.

4. **Co-PI**, Imperial–CNRS Collaboration Grant, project: “Renormalization and rigidity of complex box mappings", jointly w/ D. Schleicher (Aix-Marseille University/France), S. van Strien (Imperial College London/UK), total budget: **£ 7 000**.
   Period: 01.01.2021–31.12.2021 (+COVID extension period).
5. **Postdoctoral researcher** in SPERIG (Spectral rigidity and integrability for billiards and geodesic flows) ERC Advanced Grant, ID: 885707, PI: Vadim Kaloshin (IST Austria), total budget: **€ 1 820 816**.
   Period: 01.09.2021–31.08.2023.
6. **Postdoctoral researcher**, **member of the steering committee**, **leading researcher of one of 4 themes (Theme A)** in HOLOGRAM (Holomorphic Dynamics connecting Geometry, Root-Finding, Algebra, and the Mandelbrot set) ERC Advanced Grant, ID: 695621, PI: Dierk Schleicher (Aix-Marseille University/France), total budget: **€ 2 312 481**.
   Period: 01.10.2016–30.09.2021.

C.4. Contracts, technological or transfer merits

1. **Co-PI**, project: “Topological data analysis in clinical trials”, company: Intego Group LLC (USA/Poland/Costa Rica/Ukraine), period: 01.02.2016–30.09.2016, budget: undisclosed.
2. **Lead Data Scientist** external to Intego Group LLC (USA/Poland/Costa Rica/Ukraine), period: 30.09.2016–present.
3. S. Glushakov, V. Balon, I. Kotenko, A. Rekalo, K. Drach, B. Chornomaz, V. Shevtsova. Systems and methods for topology-based clinical data mining, US Patent US-11069447-B2 (July 2021), holder: Intego Group LLC.
4. S. Glushakov, K. Drach, V. Shevtsova, I. Kotenko, L. Polyakova. Graph-based discovery of geometry of clinical data to reveal communities of clinical trials subjects, US Patent US-11789970-B2 (October 2023), holder: Intego Group LLC.
5. S. Glushakov, K. Drach, V. Shevtsova, I. Kotenko, L. Polyakova, O. Leonov. Automatic selection of optimal graphs with robust geometric properties in graph-based discovery of geometry of clinical data, US Patent US-12278003-B2 (April 2025), holder Intego Group LLC.

C.5. International events organized

1. Topics in Complex Dynamics 2025: Connections to Geometry and Dynamics, June 2-6, 2025, University of Barcelona (research summer school for PhD students and early career researchers, #participants=75).
2. *The European Mathematical Society Summer School “Topics in Complex Dynamics 2023”*, June 19-23, 2023, University of Barcelona (research summer school for PhD students and early career researchers, #participants=50).
3. *Seminar Series “DynamIST”*, Institute of Science and Technology Austria, Jan. 2022-Aug. 2023 (over 40 external guests, including A. Avila, M. Guardia, C. Liverani, E. Miranda, D. Peralta-Salas, A. Zorich)
4. *ABCD: Advancing Bridges in Complex Dynamics*, September 20-24, 2021, CIRM/Luminy, Marseille/France (conference, #participants=147).
5. *Modern Mathematics – International Summer School for Students*, July 1-11, 2017, Jacobs University Bremen/Germany (summer school for merit-based pre-selected international students, #participants=130).

C.6. Other merits

- Referee for the journals (21 journals): *Adv. in Mathematics, Annales de l’Institut Fourier, The American Math. Monthly, Applied Mathematics and Computation, Composito Mathematica, Conf. Geom. and Dynamics, Electronic J. Combinatorics, Forum Mathematicum, GAFA, IMRN, J. Difference Equations and Applications, Journal of Geometric Analysis, J. Math. Phys. Anal. Geom., Nonlinearity, Proceedings Mathematical Sciences (India), Proceedings of the LMS, Quantitative Theory of Dynamical Systems, Revista Matematica Iberoamericana, Rocky Mountain J. Math, Transactions of the AMS, Ukrainian Mathematical Journal.*
- Member of the Selection Committee of the Heidelberg Laurate Forum (2023-present).