

PERIOD 2016-2020

The following mathematicians have worked in the Department of Algebra and Algebraic Geometry in the period 2016-2020: Piotr Achinger, Maciej Borodzik, Aleksandra Borówka, Jarosław Buczyński, Przemysław Chojecki, Sławomir Cynk, Lionel Darondeau, Maciej Dołęga, Boulous El Hilany, Christophe Eyrat, Łucja Farnik, Benoit Guerville-Balle, Joachim Jelisiejew, Grzegorz Kapustka, Michał Kapustka, Wojciech Kucharz, Adrian Langer, Hanieh Keneshlou, Marcin Lara, Grzegorz Malara, Michał Marcinkowski, Mateusz Michałek, Henryk Michalewski, Karol Palka, Tomasz Pełka, Piotr Pokora, Piotr Pragacz (head), Filip Rupniewski, Tomasz Szemberg, Saurabh Trivedi, Masha Vlasenko, Alexander Youcis.

The leading topic in the department is still complex algebraic geometry and the spectrum of the interests in the department (displayed in alphabetical order) has included:

- Affine algebraic geometry (Palka, Pełka)
- Algebraic combinatorics (Dołęga)
- Algebraic geometry in positive characteristic (Achinger, Langer)
- Arithmetic algebraic geometry (Achinger, Lara, Vlasenko, Youcis)
- Calabi-Yau varieties (Cynk, G.Kapustka, M.Kapustka)
- Characteristic classes (Darondeau, Pragacz)
- Combinatorial methods in geometry (Michałek)
- Enumerative geometry (Dołęga, Pragacz)
- Hilbert schemes (Jelisiejew)
- Holomorphic contact and symplectic geometry (Buczyński, G.Kapustka, M.Kapustka)
- Hyperbolic varieties (Darondeau)
- Intersection theory and Schubert calculus (Darondeau, Pragacz)
- Linear systems (Farnik, Malara, Szemberg)
- Moduli spaces (Keneshlou, Langer)
- Number theory (Vlasenko)
- Positivity in algebraic geometry (Pragacz)
- Real algebraic geometry (Kucharz)
- Representation theory (Dołęga)
- Secant varieties and ranks of tensors (Buczyński, Jelisiejew, Rupniewski)
- Singularities (Borodzik, El Hilany, Eyrat, Trivedi)
- Tangency and Łojasiewicz exponents (Eyrat, Pragacz)
- Vector bundles (Langer)

The center of mathematical life of the department is again the seminar IMPANGA. The following mathematicians conducted with P. Pragacz the seminar: in 2015/16 A. Langer, in 2016/17 C. Eyrat and A. Langer, in 2017/20 C. Eyrat and M. Kapustka. The seminar meets every second Friday (for two sessions) and gathers algebraic geometers from all around Poland (notably from Warsaw, Kraków, Poznań, Gdańsk, Szczecin and Wrocław). Usually we have 14 meetings of the seminar in an academic year. The speakers at the IMPANGA Seminar have included: H. Esnault, H. Hamm, T. Krasieński, W. Kucharz, J.M. Landsberg, R. Laterveer, T. Mostowski, A. Nemethi, K. O'Grady, A. Parusiński, M. Roth, S. Schroer and J. Schuermann. On January 31, 2020, we hosted the 400th meeting of the IMPANGA seminar with speakers: F. Catanese and Le Dung Trang. Due to the COVID-19 pandemic, the last 4 meetings in Spring 2020 proceeded online.

An important event was publication in 2018 of the proceedings of the conference IMPANGA 15 which held in April 2015 and was organized by participants of the seminar. The volume "Schubert Varieties, Equivariant Cohomology and Characteristic Classes, Impanga 15" appeared in EMS Series of Congress Reports. The editors were: J. Buczyński, M. Michałek and E. Postingshel. Apart from a collection of contributions by the attendees of the conference IMPANGA 15, the book contains the notes from the major lecture series of the seminar in the period 2010-2015. Both original research papers and self-contained expository surveys can be found there. The articles circulate around a broad range of topics within algebraic geometry such as

vector bundles, Schubert varieties, degeneracy loci, homogeneous spaces, equivariant cohomology, Thom polynomials, characteristic classes, symmetric functions and algebraic geometry in positive characteristic.

Members of the department organized several workshops and conferences.

M. Donten-Bury, G. Kapustka, M. Kapustka, G. Mongardi and P. Pragacz organized in the period 11-15.09.2017, at the Banach Center in Warsaw, the Workshop "Periods and Ricci flat manifolds".

G. Kapustka and M. Kapustka organized in Kraków, in the period 18-22.05.2018, the Research Group "Motives of Calabi-Yau manifolds".

K. Palka, J. Pawlikowski, T. Pełka and J. Wiśniewski organized at the Banach Center in Warsaw, in the period 28.05-1.06.2018, the conference "Algebraic Geometry - Mariusz Koras in memoriam".

C. Eyrat is a coorganizer of the "Gdańsk-Kraków-Łódź-Warszawa Singularity Seminar", which proceeded in two sessions: in Warsaw in June 2019, and in Kraków in December 2019.

P. Achinger, H. Esnault and J. Fresan organized at the Banach Center in Warsaw, in the period 23-27.09.2019, the conference "Wild Ramification and Irregular Singularities".

Members of the department participated at Simons Semesters in algebraic geometry organized in 2016 by J. Buczyński, S. Cynk and T. Szemberg, and in 2018 by P. Achinger, J. Buczyński, N. Ilten and M. Vlasenko.

Due to the COVID-19 pandemic the Banach Center Workshop "Branched coverings and symmetric functions" conducted by M. Dołęga, and planned for April 2020 did not take place, and is postponed to some later time.

In 2019 two Committees: Organizing and Scientific advanced organization of the conference IMPANGA 20 on Schubert varieties. The Organizing Committee was: C. Eyrat, G. Kapustka, M. Kapustka, P. Pragacz and H. Tutaj-Gasińska. The Scientific Committee was: D. Anderson, S. Billey, I. Coskun, L. Manivel and A. Yong. Due to the COVID-19 pandemic the conference IMPANGA 20 planned for June 21-27, 2020 in Będlewo did not take place. We hope to be able to organize this conference during the summer 2021 in the same place. The new planned date is July 11-17, 2021.

For more on Department of Algebra and Algebraic Geometry, please consult: <http://www.impan.pl/~pragacz/impanga.htm>

SELECTED PUBLICATIONS IN THE PERIOD 2016-2020:

P. Achinger, Wild ramification and $K(\pi, 1)$ spaces, *Invent. Math.* 210 (2017), no. 2, 453-499.

P. Achinger, J. Witaszek, M. Zdanowicz, Global Frobenius liftability I, Preprint 2017, revised in 2019, to appear in *Journal of the European Mathematical Society*.

F. Beukers, M. Vlasenko, Dwork Crystals I, *International Mathematics Research Notices*, 2020 (<https://doi.org/10.1093/imrn/rnaa119>).

F. Beukers, M. Vlasenko, Dwork Crystals II, *International Mathematics Research Notices*, 2020 (<https://doi.org/10.1093/imrn/rnaa120>).

J. Bochnak, W. Kucharz, Global variants of Hartogs' theorem, *Arch. Math.* 113

(2019), 281-290.

M. Borodzik, E. Gorsky, Immersed concordances of links and Heegaard Floer homology, arXiv:1601.07507.

M. Borodzik, J. Horn, Involutive Heegaard Floer homology and rational cuspidal curves, with Appendix by Andrzej Schinzel, arXiv:1609.08303.

A. Borówka, Quaternion-Kähler manifolds near maximal fixed point sets of S^1 -symmetries, *Annali di matematica pura ed applicata* 199, pages 1243-1262 (2020) (<https://link.springer.com/article/10.1007/s10231-019-00920-2>).

M. Branderbursky, M. Marcinkowski, Bounded cohomology of transformation groups (<https://arxiv.org/abs/1902.11067>).

W. Buczyńska, J. Buczyński, Apolarity, border rank and multigraded Hilbert scheme, arXiv:1910.01944.

J. Buczyński, T. Januszkiewicz, J. Jelisiejew, M. Michałek, Constructions of k -regular maps using finite local schemes, *Journal of European Mathematical Society*, 21, no.6 (2019), 1775-1808.

J. Buczyński, E. Postinghel, F. Rupniewski, On Strassen's rank additivity for small three-way tensors, *SIAM J. Matrix Anal. Appl.*, 2020, 41(1), 106-133, DOI: 10.1137/19M1243099, arXiv:1902.06582.

J. Buczyński, J.A. Wiśniewski, with an appendix by A. Weber, Algebraic torus actions on contact manifolds, arXiv:1802.05002, to appear in *Journal of Differential Geometry*.

G. Chapuy, M. Dołęga, Non-orientable branched coverings, b -Hurwitz numbers, and positivity for multiparametric Jack expansions, arXiv:2004.07824.

L. Darondeau, P. Pragacz, Universal Gysin formulas for flag bundles, *International Journal of Mathematics* 28, no.11 (2017) 1750077 (23 pages).

L. Darondeau, P. Pragacz, Gysin maps, duality, and Schubert classes, *Fundamenta Mathematicae* 244 (2019), 191-208.

M. Dołęga, V. Féray, Gaussian fluctuations of Young diagrams and structure constants of Jack characters, *Duke Math. J.*, 165 (7), 1193-1282, 2016.

W. Domitrz, P. Mormul, P. Pragacz, Order of tangency between manifolds, to appear in "Schubert Calculus and its applications in combinatorics and representation theory", *Springer Proceedings in Mathematics & Statistics* 332.

A. Dubouloz, K. Palka, The Jacobian Conjecture fails for pseudo-planes, *Adv. Math.* 339 (2018), 248-284.

B. El Hilany, Describing the Jelonek set of polynomial maps via Newton polytopes, arXiv:1909.07016.

B. El Hilany, Counting isolated points outside the image of a polynomial map, arXiv:1909.08339.

C. Eyrál, M. Oka, Non-compact Newton boundary and Whitney equisingularity for non-isolated singularities, *Adv. Math.* 316 (2017) 94-113.

C. Eyrál, P. Pragacz, On some properties of the Łojasiewicz exponent, arXiv: 2003.13031.

C. Eyrál, M. Ruas, On the Zariski multiplicity conjecture for weighted homogeneous and Newton non-degenerate line singularities, *Internat. J. Math.* 30 no.11 (2019), 1950053, 17 pages.

B. Guerville-Ballé, Topology and homotopy of lattice isomorphic arrangements, *Proc. Amer. Math. Soc.* 148 (2020), 2193-2200.

J. Jelisiejew, Pathologies on the Hilbert scheme of points, *Inventiones Math.* doi: 10.1007/s00222-019-00939-5.

J. Jelisiejew, G. Kapustka, M. Kapustka, Smoothable zero dimensional schemes and special projections of algebraic varieties, *Math. Nachr.* 292 (2019), no. 9, 2018-2027. DOI: <https://doi.org/10.1002/mana.201800327>.

M. Kapustka, M. Rampazzo, Torelli problem for Calabi-Yau threefolds with GLSM description. *Commun. Number Theory Phys.* 13 (2019), no. 4, 725-761, DOI: <https://dx.doi.org/10.4310/CNTP.2019.v13.n4.a2>.

H. Keneshlou, F. Tanturri, On the unirationality of moduli spaces of pointed curves, arXiv: 2003.07888.

M. Koras, K. Palka, The Coolidge-Nagata conjecture, *Duke Math. J.* 166 (2017), No. 16, 3085-3145.

W. Kucharz, K. Kurdyka, Rational representation of real functions, *Pure Appl.*

Math. Q., accepted, 14 pages.

A. Langer, The Bogomolov-Miyaoka-Yau inequality for logarithmic surfaces in positive characteristic, *Duke Math. J.* 165 (2016) 2737-2769.

M. Lara, Homotopy exact sequence for the pro- ℓ -étale fundamental group I, arXiv:1910.14015, 2019.

M. Lara. Homotopy exact sequence for the pro- ℓ -étale fundamental group II, arXiv:1911.01884, 2019.

M. Michałek, Y. Shitov, Quantum version of Wielandt's Inequality revisited, *IEEE Transactions on Information Theory* 65, no. 8, (2019), 5239-5242 (<https://doi.org/10.1109/TIT.2019.2897772>).

K. Palka, Cuspidal curves, minimal models and Zaidenberg's finiteness conjecture, *J. Reine Angew. Math. (Crelle's Journal)*, 747 (2019), 147-174.

P. Pragacz, On a certain family of $U(b)$ -modules, in: "Schubert varieties, equivariant cohomology and characteristic classes, IMPANGA 15", EMS Ser. Congr. Rep., EMS Publ. House, Zurich (2018), 203-224.

September 2020

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