Laura Brustenga i Moncusí

✉ brust@math.ku.dk
⌂ laurabmo.xyz
⬤ LauraBMo

Employment

01/2020–12/2021	**Postdoc**, *University of Copenhagen*, Denmark, (Mathematical Biology group). Supervised by Elisenda Feliu (funded by Novo Nordisk Foundation).

Education

01/2020   **PhD**, *Universitat Autònoma de Barcelona*, Spain.
Title: Parametrising clusters of sections
I did a foundational work introducing and studying spaces parametrising infinitesimal deformations of sections of a morphism, the generalisation of Kleiman's iterated blow ups to the "relative case". I also introduced and studied blow up split section families (blow up §-families), a generalisation of blow ups suited for parameter spaces.
Supervisor: Joaquim Roé

09/2010–02/2013   **Master in Advanced Mathematics**, *Universitat Autònoma de Barcelona*, Spain.

09/2005–07/2010   **Bachelor of Science**, *Universitat Autònoma de Barcelona*, Spain (5-years program).

Fellowships

09/2019–12/2019   **Visiting research**, *Technische Universität Berlin*, Germany (funded by Einstein Foundation project "Nonlinear Algebra").

09/2016–12/2019   **Predoctoral research**, *Universitat Autònoma de Barcelona*, Spain (funded by the Department of Mathematics (PIF)).

Publications

[1] *Inverting catalecticants of ternary quartics* (with E. Cazzador, R. Homs), Le Matematiche (to appear)
We study, by means of numerical and classical methods, the reciprocal variety of catalecticants matrices associated to ternary quartic forms as a subsapce of symmetric matrices. Numerically, we obtain that its degree is 85 and its ML-degree is 36. We show that, unlike for bianry forms, in fact this two invariants must be different and that only the rank-1 loci contributes to its degree.

[2] *The Waring rank of binary binomial forms* (with S. K. Masuti), Pac. J. Math. (to appear)
We establish an explicit formula for the Waring rank of every binary binomial form.

[3] *96120: The degree of the linear orbit of a cubic surface* (with S. Timme and M. Weinstein) Le Matematiche 75 (2), 425-437.
We compute, by means of Numerical Algebraic Geometry (homotopy continuation), the degree of the orbit of a general quaternary form of degree 3 by the action of $PGL(\mathbb{C}, 4)$.

[4] *On the universal scheme of r-relative clusters of a family*, Comm. in Algebra, 45, (2014)
We introduce spaces parametrising infinitesimal deformations of sections of a morphism, the generalisation of Kleiman's iterated blow ups to the "relative case". We also show that a recursive constructions, analogue to Kleiman's, is possible.

Preprints

[5] *Disguised toric dynamical systems* (with G. Craciun and M.-Ş. Sorea), Arxiv 2006.01289 (submitted)
We elaborate an algorithm to compute the disguised toric locus of a reaction network. We illustrate it with several examples, interesting by themselves. For example, we show that globally stable dynamical systems are not necessarily toric.

[6] *The blow up split section family*, Arxiv 1808.03062
We introduce blow up §-families, a generalisation of blow ups suited for parameter spaces. We generalise the fact that blow ups are birational maps to this larger class of morphisms. We also show that blow up §-families are the natural substitute for blow ups to generalise Kleiman's iterated blow ups to the "relative case", the iterative construction that in [1] we showed was possible.

Invited talks

Conferences

02/2021 **Lightning Talks: Sage/Oscar Days for Combinatorial Algebraic Geometry**, *ICERM at Brown University*, USA.
Talk: Multistationarity in chemical reaction networks (5 min)

04/2020 **Nonlinear Algebra Seminar Online**, *Max Planck Institute for Mathematics in the Sciences*, Germany.
Talk: Reaction networks and toric systems (30 min)

06/2019 **BMS-BGSMath Junior Meeting 2019**, *Zuse Institute Berlin*, Germany.
Talk: Clusters of sections for smooth families (30 min)

02/2019 **Biennial Congress of the Royal Spanish Mathematical Society**, *Universidad de Cantabria*, Spain.
Talk: Relative clusters for smooth families (30 min)

03/2018 **Ideals of Powers and Powers of Ideals**, *Politecnico di Torino*, Italy.
Talk: Waring rank for forms: binary binomials and some enumerative geometry (60 min)

Seminars and colloquia

10/2019 **Seminar on Discrete and Convex Geometry**, *Technische Universität Berlin*, Germany.
Talk: Numerically computing the local dimension of an algebraic set (60 min)

06/2019 **Very Informal Seminar**, *Universitat Autònoma de Barcelona*, Spain.
Talk: Numerically computing the local dimension of an algebraic set (30 min)

03/2019 **Seminar on Nonlinear Algebra**, *Max Planck Institute for Mathematics in the Sciences*, Germany.
Talk: On the Waring rank of binary forms: The binomial formula and a dihedral cover of rank two forms (60 min)

02/2019 **Algebraic Geometry Seminar of Barcelona**, *Universitat de Barcelona*, Spain.
Talk: Relative clusters for smooth families (60 min)

05/2018 **Problems Seminar**, *Stockholms universitet hem*, Sweden.
Talk: On the universal scheme of r-relative clusters of a family (60 min)

01/2018 **Very Informal Seminar**, *Universitat Autònoma de Barcelona*, Spain.
Talk: What is a scheme? (30 min)

Posters

10/2019 **Opening Conference of Thematic Einstein Semester on Algebraic Geometry Varieties, Polyhedra, Computation**, *Freie Universität Berlin*, Germany.
Poster: The blow up split section family

03/2019 **Women in Homotopy Theory and Algebraic Geometry II**, *Zuse Institute Berlin*, Germany.
Poster: The blow up split section family

Long Research Stays

09/2019–12/2019 **(10 weeks)**, *Technischen Universität Berlin*, Germany, (Discrete Mathematics/Geometry group).
Tutors: Michael Joswig and Bernd Sturmfels

03/2019–05/2019 **(12 weeks)**, *Max Planck Institute for Mathematics in the Sciences*, Germany, (Nonlinear Algebra group).
Tutor: Bernd Sturmfels

04/2018–06/2018 **(12 weeks)**, *Kungliga Tekniska Högskolan (KTH Stockholm)*, Sweden.
Tutor: Roy Skjelnes

Teaching

Education

2013–2014 **Màster en Formació del Professorat (Matemàtiques)**, *Interuniversitari: UAB, UPC, UB, UPF, UOC,* Pedagogical and didactic training to teach in secondary education.

2021 **Introduction to University Pedagogy**, *University of Copenhagen*, 4 day course that provides you with the competences to plan, carry out and evaluate your own teaching.

Lecturer/course coordinator

2019–2020 **Topics in Mathematics for the Traveling Student (Spanish course)**, *4 month bachelor course at UCPH.*

2015–2016 **Mathematics**, *Secondary school, at IES Gerbert d'Aurillac.*

2015–2016 **Mathematics**, *High school, at IES Gerbert d'Aurillac.*

Teaching assistant

Spring 2021 **Algebraic Geometry I**, *Master course at UCPH.*

2016–2018 **Statistics**, *Bachelor course at UAB.*

2016–2018 **Biostatistics**, *Bachelor course at UAB.*

Others

Funding

11/2018 **Funded to attend to "Workshop on Young Perspectives in Deformation Theory"**, *Politecnico di Torino*, Torino, Italy.

Jobs

01/2014–12/2015 **Research Assistant**, *Barcelona Graduate School of Economics, Fundació Priv.*, Universitat Autònoma de Barcelona, Spain.
I enlarged the data base of exercises of ACME. A digital platform for personalised learning and assessment to universities.

09/2010–07/2011 **Research Assistant**, *Department of mathematics*, Universitat Autònoma de Barcelona, Spain.
I created a web form to generate a proposal of adaptation of student plan to the new Bologna Statistic degree form the old diplomas of each catalan university.

Dissemination activities

02/2018 **Matematiques com tu**, *Institut d'Estudis Catalans*, Spain.
Organization of the workshop "Xperimentant les matemàtiques", activity for the International Day of Women and Girls in Science.

– (weekend workshops part of a year-long program for high school students with special interest and talent for mathematics)

09/2018   **Bojos per les matemàtiques**, *Universitat Autònoma de Barcelona*, Spain.
Title: Conics, from Apollonius to the Projective plane.

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Title: Conics, from Apollonius to the Projective plane.

– (dissemination articles dedicated to motivate and introduce the use of all kind of mathematical software.)

[7] *Surfejant superfícies* (with Martí Prats Soler), SCM/Notícies, 46, (2020)
We present Surfer, a program to experience the relation between algebra and geometry in an interactive way.

[8] *Un tastet de topologia algebraica* (with Martí Prats Soler), SCM/Notícies, 47, (to appear)
We present Polymake, a program for research in polyhedral geometry.

Computer skills

Scientific   Singular, Macaulay2, Polymake, Octave, Maxima

OS   Unix, GNU/Linux

Languages   C++, eLisp, LaTeX, Julia