

# Laura Brustenga i Moncusí

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## Personal Details

Date of Birth 13.11.1987  
Place of Birth Campdevanol, Spain

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## Employment

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

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## 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).

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## Fellowships

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

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

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## 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 subspace of symmetric matrices. Numerically, we obtain that its degree is 85 and its ML-degree is 36. We show that, unlike for binary 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  $\mathrm{PGL}(\mathbb{C}, 4)$ .
- [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.

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## 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)

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## 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

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## 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 Skjeltne

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## 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*.

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## 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 from the old diplomas of each catalan university.

### Dissemination activities

- 02/2018 **Matemàtiques 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.

09/2019 **Bojos per les matemàtiques**, *Universitat Autònoma de Barcelona*, Spain.

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, L<sup>A</sup>T<sub>E</sub>X, Julia