

Personal

Name	Elizabeth Terezinha Gasparim
Post 1	Visiting Professor, Imecc, Unicamp
Post 2	Director of the Institute for Geometry and Physics (IGP-MCC), alongside with L. Katzarkov, M. Kontsevich, E. Lupercio and D. Sullivan
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Citizenship	Brazilian
Marital status	not married

Major research interests

Algebraic Geometry, Mathematical Physics, Algebraic Topology.

Degrees

1995	Ph. D. The University of New Mexico, USA
1991	Master of Science, UNICAMP Brazil

Career since graduation

2011 to date	Visiting Professor, UNICAMP, Brazil.
2008	Visiting Professor, UC Berkeley, USA.
2007– 2012	Lecturer, University of Edinburgh.
2001–2007	Associate Professor, New Mexico State University, USA.
2000–2001	Visiting Professor, University of Texas at Austin, USA.
1997–2000	Associate Professor, Federal University of Pernambuco, Brazil.
1996	Visiting Professor, International Centre for Theoretical Physics, Italy.

Principal research grants

2012 to date	Research Grant from Fapesp, Brazil
2009-2010	Royal Society Grant for collaboration with India, UK
2003–2006	National Science Foundation, NMSU Advance grant, USA. Included salaries for 4 research students.
2005–2006	National Science Foundation, NMSU Advance grant, USA. Research grant for teaching reduction.
2001–2007	Associateship Grant, International Centre for Theoretical Physics, Italy. For research visits and postgraduate students.
1999–2001	Research Grant from CNPQ, Brazil.
1997-1998	Research Grant from CNPQ, Brazil.

Students supervised

1. Severin Barmeier - current Ph. D. supervisor (Brazil)
2. Brian Callander - current Ph. D. supervisor (Brazil)
3. Michel Faleiros - undergraduate research 2012-2013 (Brazil)
4. Marcelo Maizman - undergraduate research 2012-2013 (Brazil)
5. Jesus Martinez Garcia - supervisor for the first year of PhD. 2011 (Edinburgh)
6. Dmitry Sakovics - second supervisor 2011 (Edinburgh)
7. Spiros Adams-Florou - second supervisor 2010-2011 (Edinburgh)
8. Zeenath Islam - undergraduate research 2011 (Edinburgh)
9. Craig Meek - undergraduate research 2011 (Edinburgh)
10. Sameed Zahoor Bhat - undergraduate research 2011 (Edinburgh)
11. Laura Iosip - undergraduate research 2011 (Edinburgh)
12. Thomas Köppe - PhD thesis supervisor 2009-2010 (Edinburgh)
13. James Gallagher - undergraduate research 2010 (Edinburgh)
14. Matt Calloway - undergraduate research 2010 (Edinburgh)
15. Carlos Cassorán Amilburu - undergraduate research 2010 (Edinburgh)
16. Scott Pirrie - undergraduate research 2010 (Edinburgh)
17. Ciaran Patrick Meachan - second supervisor 2009 (Edinburgh)
18. Craig Meek - undergraduate research 2009 (Edinburgh)
19. Joseph Crean - undergraduate research 2009 (Edinburgh)
20. John Mullan - undergraduate research 2009 (Edinburgh)
21. Guy Roger Byogman - supervisor - first year of PhD. 2006 (New Mexico State University, USA)
22. Jean Bernard - research courses PhD 2005–2006 (New Mexico State University, USA)
23. Lalitha Garimella - second supervisor Masters 2006 (New Mexico State University, USA)
24. Zac Harlow - undergraduate research 2006 (New Mexico State University, USA)
25. Santi Tasena - Masters 2004–2005 (New Mexico State University, USA)
26. Samantha Kilroy - undergraduate research 2005 (New Mexico State University, USA)
27. Megan Lockwood - undergraduate research 2004 (New Mexico State University, USA)
28. Pablo Gustavo Braz e Silva - 2003 Post-doctoral studies (International Centre for Theoretical Physics, Italy)
29. Antonio Carlos Pereira de Souza - 2000 Masters (Federal University of Pernambuco, Brazil)

Teaching Experience

Toric Geometry, Algebraic Geometry, Algebraic Topology, Riemann Surfaces, Discrete Mathematics, Counting and combinatorics, Ordinary Differential Equations, Linear Algebra with Applications, Linear algebra for informatics, Geometry and Calculus of Variations, Differential Geometry, Topics in Differential Geometry, Topology, Algebraic Topology, Characteristic classes, Complex Analysis, Real Analysis, Business Calculus, Calculus I,II, III, Advanced Calculus, Algebra, Probability, Applicable Mathematics 3, Mathematics for Informatics 2, 3, 4.

MINICOURSES: Vertex Algebras and Moduli Spaces (Belgium), Summer School on Riemann Surfaces (Recife - Brazil), Sheaf Cohomology and Mathematical Physics (India), Lefschetz Fibrations on Ad-joint Orbits (São Luís - Brazil), Geometric Theory of Surfaces (São Luís - Brazil).

Webpages and computational mathematics

1. personal page <http://www.ime.unicamp.br/~gasparim/>
2. institute page <http://www.ime.unicamp.br/~gasparim/MCC/index.html>
3. conference page <http://www.ime.unicamp.br/~gasparim/MCC/conference-maranhao2013.html>
4. conference page <http://www.ime.unicamp.br/~gasparim/curitiba/>
5. conference page <http://www.icms.org.uk/workshop.php?id=115>
6. conference page <http://www.ime.unicamp.br/~gasparim/cuba/>
7. conference poster http://www.ime.unicamp.br/~gasparim/poster_resize.jpg
8. research poster <http://www.ime.unicamp.br/~gasparim/posterbeth11.pdf>
9. Macaulay 2 code <http://www.ime.unicamp.br/~gasparim/m2code>
10. toric geometry on youtube in 2D by J. Mullan http://www.youtube.com/watch?v=fx_T1mQ5pKA
11. toric geometry on youtube in 3D by J. Mullan <http://www.youtube.com/watch?v=XJ-WmmaJPAY>

Administrative experience

2010–2011	Course coordinator for mathematics for informatics
2008–2011	Director of Studies for 30 undergraduates
2009 to date	Member of advisory committee for the postgraduate program in Paraná, Brazil
2008–2011	Library Liaison for the School of Mathematics at the University of Edinburgh and Librarian for the Edinburgh Mathematical Society
2004–2006	Head of the Mathematics Undergraduate Research Program in Theoretical and Experimental Mathematical Physics (Maths session of the Space Program Cluster), New Mexico State University, USA.
2004–2006	Head of the Recruiting Program (for recruitment of postgraduates in mathematics) New Mexico State University, USA.
2006	Faculty Adviser for WISE (Women in Science and Engineering) for the College of Arts and Sciences at New Mexico State University, USA.
1999	Vice-head and acting head of department, Federal University of Pernambuco, Brazil.

Membership of Societies

Edinburgh Mathematical Society, London Mathematical Society, American Mathematical Society.

Membership of Committees

- 2008–2011 Member of the library committee for the College of Humanities and Social Sciences, The University of Edinburgh
- 2005–2006 Chair of the Recruiting Committee, New Mexico State University, USA.
- 2001–2004 Member of the Graduate Studies Committee, New Mexico State University, USA.

Editorial work and refereeing

Referee for: Quarterly Journal of Mathematics, Communications in Mathematical Physics, Letters in Mathematical Physics, Algebraic Geometry and Topology, Glasgow Journal of Mathematics, Systems Integrability and Geometry: Methods and Applications, Rocky Mountain Journal of Mathematics, Journal of Mathematical Analysis and Applications, Manuscripta Mathematica, Mathematische Zeitschrift, Central European Journal of Mathematics, Theory and Applications of Mathematics & Computer Science, Indian Journal of Mathematics.

Items of esteem I: Small grants and supported visits in the past 5 years

- 2013 Invited visit to UFMT, Cuiabá (Brazil)
- 2013 Invited visit to University of Miami (USA)
- 2013 Invited visit to UNIVASF, Petrolina (Brazil)
- 2013 Invited visit to UFPR, Curitiba (Brazil)
- 2012 Invited visit to Oxford Mathematical Institute (UK)
- 2012 Invited visit to Budapest University (Hungary)
- 2012 Invited visit to New Mexico State University (USA)
- 2012 Invited visit to University of Miami (USA)
- 2012 Fapesp grant for a 1 month visit of D. Kaledin
- 2011 Invited visit to University of Antwerp (Belgium)
- 2010 Maxwell Institute support for visit of E. Diaconescu
- 2010 CIRM-FBK Institute Trento, 1 month supported visit
- 2010 Invited visit to Unicamp, Campinas (Brazil)
- 2010 Invited visit to UPenn, Philadelphia (USA)
- 2009–2010 Royal Society Grant for collaboration with the Physics Institute of the Indian Association for the Cultivation of Science (Kolkata) together with support for 4 collaborators
- 2009 CIRM Luminy, France — 1 month visit to coordinate research group together with support for collaborators
- 2009 FAPESP São Paulo, Brazil - grant for 3 weeks visit
- 2009 ICMS grant for RIGs with Dr. Christophe Eyrat - month of July '09.
- 2009 EMS grant for visit by Dr. Wendy Lowen
- 2009 ICMS funding for conference in June 2010, organized jointly with Dan Freed and Tony Pantev
- 2009 Support from the center for topology and quantization of moduli spaces Aarhus, Denmark, for a short visit
- 2009 LMS grant for visit of Prof. Melissa Liu
- 2008 London Mathematical Society visitor grant to support the visit of Tony Pantev of the University of Pennsylvania
- 2008 University of Edinburgh small grant for travel to Cuba

2008	International Mathematical Union support for Russian conference participants
2008	UNESCO conference grant providing support for Latin American mathematicians from Cuba, Colombia, Mexico and Brazil
2007	IHES France: 2 month visit
2007	MPIM Bonn: 1 month visit

Items of esteem II: Awards received as a student

2002, 2004, 2006	NMSU summer research award
1995	Solomon Lefschetz Instructorship
1993, 1991	Efroymsen Award
1989, 1988, 1997	Graduate Academic Merit Award
1986	Undergraduate Academic Merit Award

Items of esteem III: Selected Conference/Seminar Talks

2013	<i>Adjoint orbits and Hodge diamonds</i> , University of Miami (USA)
2012	<i>Lefschetz fibrations on adjoint orbits</i> , UPenn (USA)
2012	<i>BPS counting on singular varieties</i> , Oxford Mathematical Institute (UK)
2011	<i>Moduli of bundles on surfaces and threefolds</i> , Tel Aviv (Israel)
2011	<i>Minicourse on moduli spaces and vertex algebras</i> , Antwerp (Belgium)
2010	<i>Partition functions for theories on singular varieties</i> , UPenn Philadelphia (USA)
2010	<i>Algebraic structures on moduli spaces</i> , Cardiff University (Wales)
2009	<i>Hodge theory and singularities</i> , CIRM Luminy (France)
2009	<i>Moduli spaces and singularities</i> , Aarhus University (Denmark)
2008	<i>The Nekrasov conjecture for toric varieties</i> , WAGP, Trieste (Italy)
2007	<i>Group structures on moduli spaces</i> , IAS Princeton (USA)
2006	<i>Moduli spaces and birational transformations</i> , Oberseminar, MPIM (Germany)
2005	<i>Holomorphic surgery and the topology of moduli spaces</i> , Summer Institute on Algebraic Geometry, Seattle (USA)
2005	<i>Holomorphic surgery and instanton decay</i> , Mathematical Physics Seminar, Steklov Institute Moscow (Russia)

National invitations

I have had invited visits (with support) for one month or longer at:

2010	CIRM research center, Trento, Italy
2009	Universidade Estadual de Campinas, Brazil
2009	Centre International de Rencontres Mathématiques, Luminy, France
2008	University of Münster, Germany
2007	University of California at Berkeley, USA.
2007	Institute des Hautes Études Scientifiques, France.
2007, '05, '04	Max Planck Institute für Mathematik, Bonn, Germany.
2006	Stanford University, USA.
2004	Cambridge University, England.
2003	Kavli Institute for theoretical Physics, UC Santa Barbara, USA.

- 2002 The Isaac Newton Institute, England.
- 2001,'00,'99,'96 International Centre for Theoretical Physics, Italy.
- 2000 Stanford University, USA.
- 2000 University of Texas at Austin, USA.
- 1998 The Institute of Mathematical Sciences, Chennai, India.
- 1998 Instituto Politecnico di Torino, Italy.
- 1997 SPIC Mathematical Institute, Chennai, India.

Conference and Seminar Organization

- 2013 *Third Latin Congress on Symmetries in Geometry and Physics* Universidade Federal do Maranhão in São Luís (Brazil) (jointly with L. Katzarkov, M. Kontsevich and L. San Martin) February 1–10, 2013.
- 2013 *Conference on Homological Mirror Symmetry* University of Miami (USA) (jointly with D. Auroux, L. Katzarkov, M. Kontsevich, E. Lupercio and T. Pantev) January 28–February 1, 2013.
- 2012 *International School on TQFT, Langlands and Mirror Symmetry*, in Miami and Mexico City, January 23–February 7, 2012. This is the opening conference for the Institute on Geometry and Physics IGP–MCC, which aims to promote collaboration in Mathematics and Physics within the Americas.
- 2010 *Second Latin Congress on Symmetries in Geometry and Physics*, in Curitiba, Brazil, December 2010 (jointly with D. Kaledin, E. Hoefel and M. Jardim)
- 2010 *Hodge theoretical reflections on the string landscape*, held at ICMS Edinburgh, June 2010 (jointly with D. Freed and T. Pantev)
- 2008 *First Cuban Congress on Symmetries in Geometry and Physics*, Havana, Cuba, (jointly with D. Kaledin)
- 2007 IAS Princeton Research Seminar for the *Program for Women in Mathematics*(USA)

Seminar organization.

- 2008 to 2010 Topology and Geometry seminar – University of Edinburgh (with Andrew Ranicki)
- 2001 to 2007 Topology and Geometry seminar – New Mexico State University (with R. Staffeldt)
- 1998 to 2000 Topology and Geometry seminar – UFPE - Pernambuco, Brazil (with P. Ontaneda)

TRACK RECORD

Elizabeth Gasparim

The following is a description of some of the research appearing in my published papers.

i) Homology of instanton moduli spaces and birational transformations

The study of *local* moduli is an essential ingredient toward the understanding of the classical algebraic geometric question: How do moduli of bundles on a compact surface X change under a birational transformation of \tilde{X} ? For surfaces, the prototype of a rational map is the blow-up of a point in X . Let us denote by \tilde{X} the blown-up surface and by $\mathfrak{M}_k(Y)$ the moduli space of $SU(2)$ instantons of charge k over Y . In joint work with Pedro Ontaneda, we used the very concrete description of local moduli I gave in a previous paper to construct a non-trivial relative class in $\alpha \in H_2(\mathfrak{M}_k(\tilde{X}), \mathfrak{M}_k(X))$; thus showing that moduli of instantons react very non-trivially to birational maps on the base space.

ii) Local analytic invariants and stratification of moduli stacks

Moduli of bundles on compact varieties are labelled by rank and by topological invariants: in particular, Chern classes of the bundles, or what is equivalent, to fix the topological type. However, on a noncompact surface, there is no c_2 . In the local (noncompact) situation, to define moduli spaces, one needs finer numerical invariants. If $\pi: \tilde{X} \rightarrow X$ is the blow-up of a point in X , and E is a sheaf on \tilde{X} , then the following are analytic invariants of E depending only on the restriction of E to a small neighborhood of the exceptional curve: $h := l(R^1\pi_*E)$ and $w := l(\pi_*(E)^{\vee\vee}/\pi_*E)$. In a joint paper with E. Ballico, we showed that this pair of invariants gives the coarsest stratification of moduli stacks of bundles on $\tilde{\mathbb{C}^2}$ into Hausdorff components. We also proved the existence of locally free sheaves with any numerically admissible values of these invariants. This was the first such proof, and in fact, the analogous existence question for sheaves near a line with self-intersection < -1 remains open.

iii) The Atiyah–Jones conjecture for rational surfaces

Let $\mathfrak{M}_k(X)$ denote the moduli space of $SU(2)$ instantons of charge k on a 4-manifold X and let $\mathcal{C}(X)$ denote the space of gauge equivalence classes of connections on X . The Atiyah–Jones conjecture predicts that the inclusion $\mathfrak{M}_k(X) \rightarrow \mathcal{C}(X)$ induces a homotopy equivalence through a range. This conjecture was proved in 1993 by Boyer–Hurtubise–Milgram–Mann for the case when X is the sphere S^4 , and in 1995 by Hurtubise–Milgram for ruled surfaces. In 2005 I generalised these results, proving that the Atiyah–Jones conjecture holds true in homology for all rational surfaces. My proof comes from investigating how $\mathfrak{M}_k(X)$ reacts to a birational transformation of X , and goes by showing that if X satisfies Atiyah–Jones, then so does \tilde{X} , with equivalence in homology for the same range. In 2009 in joint work with Christophe Eyrat, we proved the stronger version of the Atiyah–Jones conjecture in homotopy for rational surfaces. Within this work, we have also calculated the fundamental group of instanton moduli spaces on rational surfaces. The remaining cases of the conjecture are still open.

iv) G.A.G.A. principle and computational algebraic geometry

One of the very celebrated results in algebraic geometry is the theorem of Serre in *Géométrie Algébrique et Géométrie Analytique* which implies that holomorphic bundles on a compact variety are algebraic. The analogous statement is false for general noncompact varieties. However, in joint work with E. Ballico and T. Köppe, we showed that if C is a curve with ample co-normal bundle inside a smooth algebraic variety, then holomorphic vector bundles on a formal neighborhood of C are algebraic. Consequently, the following two Calabi–Yaus, which appear very frequently in string theory, satisfy the G.A.G.A. principle: $\text{Tot}(\mathcal{O}_{\mathbb{P}^1}(-2))$ and $\text{Tot}(\mathcal{O}_{\mathbb{P}^1}(-1) \oplus \mathcal{O}_{\mathbb{P}^1}(-1))$. In particular, we obtain concrete constructions of moduli stacks of bundles on these spaces, and develop computer algebra algorithms in Macaulay2 that calculate numerical invariants of bundles on them. We have made these algorithms freely available to the mathematical community in an open source webpage

<http://www.maths.ed.ac.uk/~s0571100/Instanton/>.

v) Applications of computational algebraic geometry to theoretical physics

In joint work with a physicist P. Majumdar and one of my postgraduate students in Edinburgh, T. Köppe, we used the aforementioned computational algorithms to calculate instanton charges and to prove some existence/non-existence results. Sample non-existence statement: if $k > 2$, then there do not exist instantons of charge 1 on $\text{Tot}(\mathcal{O}_{\mathbb{P}^1}(-k))$. Such results are particularly useful to avoid *void* discussions: I had participated in conferences in theoretical physics where such *nonexistent* charge 1 instantons were discussed at length. On a brighter side, we do prove existence of instantons with higher charge. There are however higher gaps on charge values, and a full understanding of their behaviour remains open. The numerical sequences of instanton charges display an attractive similarity with the sequences one encounters when studying Weierstrass points on curves; further understanding of the computational features of both might uncover an unexpected relation between them.

vi) The Nekrasov conjecture for toric surfaces

The Nekrasov conjecture predicts a surprising relation between the partition function for $N = 2$ SUSY Yang–Mills theory and the Seiberg–Witten prepotential. For the case of instantons on \mathbb{R}^4

the conjecture was proven in three separate works by Nekrasov–Okounkov, Nakajima–Yoshioka, and Braverman–Etingoff. In joint work with Melissa Liu, we proved the Nekrasov conjecture for noncompact toric surfaces. In particular, for these surfaces, we observe that the change in Seiberg–Witten prepotential depends only on a formal neighborhood of the compactification divisor. We prove eight instances of the conjecture; namely, the instanton part and the perturbative parts of: pure gauge theory, gauge theory with fundamental matter, gauge theory with adjoint matter, and 5D theory compactified on a circle.

vi) BPS counting on singular varieties

BPS states are special states of supersymmetric theories, with minimal energy. BPS states have had a crucial role in establishing various duality symmetries of Superstring theory. One of the reasons for their pivotal role in studying dualities stems from the availability of information on exact masses and degeneracies of these states, which is a fortunate consequence of the very precise mathematical nature of this type of String theory. Arguably the most exciting feature of BPS counting is the connection with quantisation of black holes. It is well known that a fundamental problem of current Physics is the lack of a unique theory that encompasses both gravitational as well as quantum physics, in the same manner as the standard model encompasses both Maxwell theory of electromagnetism alongside with the QCD theory of quarks and gluons. To this end, black holes need to be quantised, and such quantisation then gives rise to integer values invariants; which theory of discrete invariants goes by the name of counting of black hole counting and has been related to BPS counting precisely in various sources, eg. papers of Ashoke Sen. Nevertheless, the counting relies on construction of moduli spaces, which in turn manifest a wall-crossing phenomenon of the same nature as the one found in Lie theory, but rather more intricate (see papers of Kontsevich–Soibelman) with the resulting counting depending on the choice of region of stability. We extend the BPS counting theory from smooth to singular Calabi–Yau threefolds by considering altogether the various crepant resolutions, computing the partition functions for all possible regions of stability then averaging over them. As a result, our construction does not depend on the choice of resolution. We present a closed form of the answer for curve counting theories such as Donaldson–Tomas and Gromov–Witten theories, showing that the result is homogeneous on McMahon factors.

vii) Moduli stacks

In joint work with O. Ben-Bassat we studied two presentations of the stack of bundles on local surfaces. From the point of view of groupoid actions we showed that the stacks can be obtained by actions formulated as Möbius transformations on the space of deformations of split bundles. This is interesting because it gives concrete descriptions of stacks of bundles on varieties of dimension greater than one. On a forthcoming paper we will describe the deformations theory of these stacks.

PUBLICATIONS

Elizabeth Gasparim

Published articles

1. *Moduli Stacks of Bundles on Local Surfaces*, with O. Ben-Bassat, Homological Mirror Symmetry and Tropical Geometry (Cetraro, Italy, July 2-8, 2011) to appear in Springer Lecture Notes in Mathematics (2013).
2. *Isomorphisms of moduli of bundles on surfaces and threefolds*, with C. Cassorán Amilburu, B. Callander, and S. Barmeier, Proc. Second Latin Congress on Symmetries in Geometry and Physics (2010), *Matemática Contemporânea* **41** (2012) 1–10.
3. *BPS state counting on singular varieties*, with T. Köppe, P. Majumdar and K. Ray, *J. Phys. A* **45** (2012), no. 26, 265–401.

4. *On the geometry of moduli spaces of antiselfdual connections*, with E. Ballico and C. Eyrál, *Topology Appl.* **159** no. 3 (2012) 633–645.
5. *Cohomology gaps for sheaves on threefolds*, with E. Ballico, *J. Geometry and Symmetries in Phys.* **21** (2011) 29–39.
6. *Sheaves on singular varieties*, with T. Köppe, *J. Singularities* **2** (2010) 56–66, Singularities in Aahrus, August 2009.
7. *The Nekrasov conjecture for toric surfaces*, with Melissa Liu, *Comm. Math. Phys.* **293**, no. 3, 661–700 (2010).
8. *Smoothing of rational m -ropes*, with E. Ballico and T. Köppe, *Cent. Eur. J. Math.* **7** no. 3, 623–628 (2009).
9. *Local moduli of holomorphic bundles*, with E. Ballico and T. Köppe, *J. Pure Appl. Algebra* **213**, 397–408 (2009).
10. *Vector bundles near negative curves: moduli and local Euler characteristic*, with E. Ballico and T. Köppe. *Comm. Algebra* **37** no. 8, 2688–2713 (2009).
11. *The Atiyah–Jones conjecture for rational surfaces*, *Advances Math.* **218**, 1027–1050 (2008).
12. *Local holomorphic Euler characteristic and instanton decay*, with T. Köppe and P. Majumdar, *Pure Appl. Math. Q.* **4**, no. 2, Special Issue: In honor of Fedya Bogomolov, Part 1, 161–179 (2008).
13. *Multiplicity of complex hypersurface singularities, Rouché satellites and Zariski’s problem*, with C. Eyrál, *C. R. Math. Acad. Sci. Paris* **344**, no. 10, 631–634 (2007).
14. *Three applications of instanton numbers*, with P. Ontaneda, *Comm. Math. Phys.* **270**, no. 1, 1–12 (2007).
15. *Computing instanton numbers of curve singularities*, with I. Swanson, *J. Symbolic Comput.* **40**, no. 2, 965–978 (2005).
16. *Vector bundles on a three-dimensional neighborhood of a ruled surface*, with E. Ballico, *J. Pure Appl. Algebra* **195**, no. 1, 7–19 (2005).
17. *The Atiyah–Jones conjecture for rational surfaces*, with R. J. Milgram, MPIM Bonn preprint, 2004–2014 (2004).
18. *Vector bundles on a neighborhood of a curve in a surface and elementary transformations*, with E. Ballico, *Forum Math.* **15**, no. 1, 115–122 (2003).
19. *Numerical invariants for bundles on blow-ups*, with E. Ballico, *Proc. Amer. Math. Soc.* **130**, no. 1, 23–32 (2002).
20. *Two applications of instanton numbers*, Isaac Newton Inst. Preprint Series, no. NI02022-HDG, 1–15 (2002).
21. *Holomorphic vector bundles on holomorphically convex complex surfaces*, with E. Ballico, *Matematiche (Catania)* **55**, no. 1, 3–15 (2001).
22. *Chern classes of bundles on blown-up surfaces*, *Comm. Algebra* **28**, no. 10, 4919–4926 (2000).
23. *Vector bundles on a formal neighborhood of a curve in a surface*, with E. Ballico, *Rocky Mountain J. Math.* **30**, no. 3, 795–814 (2000).
24. *Holomorphic and algebraic vector bundles on 0-convex algebraic surfaces*, with E. Ballico, *Proc. Indian Acad. Sci.* **109**, no. 4, 353–358 (1999).

25. *On the topology of holomorphic bundles*, Bol. Soc. Parana. Mat. **18**, no. 1–2, 1–7 (1998).
26. *Rank two bundles on the blow-up of \mathbb{C}^2* , J. Algebra **199**, no. 2, 581–590 (1998).
27. *Chern classes of bundles over rational surfaces*, Instituto Politecnico di Torino Rapporto Interno **30**, (1998).
28. *Holomorphic bundles on $\mathcal{O}(-k)$ are algebraic*, Comm. Algebra **25**, no. 9, 3001–3009 (1997).
29. *GAGA para variedades não compactas*, Anais Acad. Bras. Ciências **69**, no. 4 (1997).
30. *Fibrados Holomórficos sobre blow-ups*, XXX Anniversary P.U.C. Peru, Pro-Math. **10**, no. 20 (1996).

Submitted for publication

- *Lefschetz fibrations on adjoint orbits*, with Luis A. B. San Martin and Lino Grama.
- *Hodge diamonds of adjoint orbits*, with B. Callander.

Notes, reviews and review articles

- Reviews: Reviewed several articles for Math. Reviews and Zentralblatt Math.
- Lecture Notes: Wrote about 20 lecture notes in algebraic geometry and topology, for courses taught in Brazil, India, New Mexico, Berkeley, and Edinburgh.

Articles in progress

1. *Rank-level dualities for local Calabi-Yaus*, with Melissa Liu.
2. *Non-commutative deformations of moduli stacks*.
3. *Vertex algebra structures on local moduli*.
4. *Adjoint orbits and Lagrangean graphs*, with Luis A. B. San Martin and Lino Grama.

Some Talks

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| 2013 | <i>Geometria em dimensões 4 e 6</i> , Colloquium, Federal Univ. Vale do São Francisco, Juazeiro (Brazil) invited by L. M. Silva |
| 2012 | <i>Geometria das variedades algébricas</i> , Escola de Geometria, Federal University, Maranhão (Brazil) invited by J. Marão |
| 2012 | <i>Construções de espaços de dimensão 4</i> , Colloquium, State University Maranhão (Brazil) invited by F. Silva |
| 2012 | <i>Lefschetz fibrations on adjoint orbits</i> , Geometry Seminar, University of Miami (USA) invited by L. Katzarkov |
| 2012 | <i>BPS counting on singular varieties</i> , Topology Seminar, New Mexico State University (USA) invited by D. Ramras |
| 2012 | <i>Lefschetz fibrations and Lie Theory</i> , Colloquium, New Mexico State University (USA) invited by G. Bezhanishvili |
| 2012 | <i>Lefschetz fibrations on adjoint orbits</i> , Algebraic Geometry Seminar, UPenn (USA) invited by T. Pantev |

- 2012 *Lefschetz fibrations on adjoint orbits*, II School and Workshop in Lie Theory, Federal University of Maringá, (Brazil), invited by R. Fukuoka
- 2012 *Lefschetz fibrations on adjoint orbits*, Topology Seminar, University of Edinburgh, (UK), invited by A. Ranicki
- 2012 *BPS counting on singular varieties*, Mathematical Physics Seminar, Heriot Watt University (UK), invited C. Sämann
- 2012 *Lefschetz fibrations on adjoint orbits*, Oxford Mathematical Institute (UK), invited by S-T. Tsou
- 2012 *BPS counting on singular varieties*, Mathematical Physics in Bahia (Brazil), invited by G. Dito
- 2011 *Topologia de espaços de moduli*, Seminário de geometria algébrica, USP São Carlos (Brasil), invited by D. Levkovitz
- 2011 *BPS counting on singular varieties*, Physics Colloquium, International Institute of Physics, Natal (Brazil), invited by A. Ferraz
- 2011 *Moduli of bundles on surfaces and threefolds*, Algebraic Geometry Seminar, Tel Aviv University (Israel), invited by J. Bernstein
- 2011 *Moduli spaces and vertex algebras*, Algebra Seminar, University of Antwerp (Belgium), invited by W. Lowen
- 2010 *BPS counting on singular varieties*, Geometry Seminar, University of Pennsylvania (USA), invited by T. Pantev
- 2010 *Moduli spaces and holomorphic structures*, Geometry Seminar, University of Alicante (Spain), invited by S. Segura-Gomis
- 2010 *Moduli of bundles on surfaces and threefolds*, Geometry Seminar, University of Murcia (Spain), invited by A. Miguel-Izquierdo
- 2009 *Moduli spaces and numerical invariants*, Colloquium, Queen's University Belfast (Ireland), invited by T. Hüttermann
- 2009 *Level-rank duality*, Workshop in algebraic geometry and physics, Maresias (Brazil), invited by U. Bruzzo
- 2009 *Mirror symmetry and moduli spaces*, geometry seminar, Universidade Estadual de Campinas (Brazil), invited by M. Jardim
- 2009 *Moduli spaces and singularities*, Conference in honor of the 60th birthday of A. Du Plessis, Aarhus University (Denmark), invited by C. Eyrat
- 2009 *Hodge theory and singularities*, CIRM Luminy (France), invited by J. P. Brasselet
- 2009 *The Nekrasov conjecture for toric varieties*, The University of Philadelphia (USA), invited by T. Pantev
- 2009 *The Nekrasov conjecture for toric varieties*, Columbia University (USA), invited by M. Thaddeus
- 2009 *The Nekrasov conjecture for toric varieties*, University of Texas at Austin (USA), invited by D. Freed

- 2009 *Instantons and String Theories*, Colloquium, New Mexico State University, invited by G. Bezhanishvili
- 2008 *The Nekrasov conjecture for toric varieties*, Glasgow University (Scotland), invited by A. Craw
- 2008 *Topology of moduli spaces*, topology seminar, Aarhus University (Denmark), invited by A. Du Plessis
- 2008 *Moduli of bundles on surfaces and threefolds*, University of Augsburg (Germany), invited by K. Wendland
- 2008 *Instantons and String Theories*, geometry seminar, University of Liverpool (England), invited by A. Gorinov
- 2008 *The Nekrasov conjecture for toric varieties*, Workshop in algebraic geometry and physics, Trieste (Italy), invited by U. Bruzzo
- 2008 *Instantons and Toric varieties*, Colloquium, University of California at Davis (USA), invited by J. Shultens
- 2008 *The Nekrasov conjecture for toric varieties*, Algebraic Geometry Seminar, Berkeley University (USA), invited by M. Haiman
- 2008 *The Nekrasov conjecture for toric varieties*, Algebraic Geometry Seminar, University of Zürich (Switzerland), invited by C. Okonek
- 2007 *Topology of Moduli Spaces*, algebraic geometry seminar, University of Illinois at Chicago (USA), invited by J. Bona
- 2007 *Group structures on moduli spaces*, IAS Princeton (USA), invited by K. Uhlenbeck
- 2007 *Instantons, branes and singularities*, Mathematical Physics Seminar, MPIM Bonn, (Germany), invited by M. Marcolli
- 2007 *Topology of moduli spaces*, Topology Seminar, Aberdeen, (Scotland), invited by M. Weiss
- 2007 *Vector bundles and infinite holomorphy*, Analysis Seminar, Dublin (Ireland), invited by S. Dineen
- 2006 *Moduli of bundles and birational transformations*, Oberseminar, MPIM Bonn, (Germany), invited by D. Zagier
- 2006 *Moduli spaces and birational transformations*, Topology seminar, Humboldt University Berlin (Germany), invited by H. Kurke
- 2006 *The Atiyah–Jones conjecture for rational surfaces*, Universität Münster (Germany), invited by H. Hamm
- 2006 *Moduli of bundles on Curves and Surfaces*, Stanford University (USA), invited by R. Cohen
- 2005 *Holomorphic surgery and the topology of moduli spaces*, Summer Institute on Algebraic Geometry, University of Washington, Seattle (USA) invited by L. Katzarkov
- 2005 *Topology of moduli spaces and local Euler characteristic*, Topology Seminar, MPIM Bonn (Germany) invited by H. Baues
- 2005 *Holomorphic surgery and instanton decay*, Mathematical Physics Seminar, Steklov Institute Moscow (Russia) invited by I. Volovich

- 2005 *Holomorphic surgery for vector bundles*, Seminar in Algebraic Geometry, University of Texas at Austin (USA), invited by G. Farkas
- 2004 *Surgery for holomorphic bundles*, Colloquium, University of Miami, invited by L. Katzarkov
- 2004 *The Atiyah–Jones conjecture for rational surfaces*, Geometry Seminar, University of Arizona, invited by Y. Hu
- 2004 *Surgery for holomorphic bundles*, Sectional Meeting of the American Mathematical Society, Albuquerque (USA) invited by H. Abo
- 2004 *Moduli of bundles on surfaces*, Algebraic Geometry Seminar, Tokyo Metropolitan University (Japan), invited by M. Oka
- 2004 *The Atiyah–Jones conjecture for rational surfaces*, Geometry seminar, Oxford University (England), invited by N. Hitchin
- 2004 *The Atiyah–Jones conjecture for rational surfaces*, Algebraic Geometry seminar, University of Zurich (Switzerland), invited by C. Okonek
- 2004 *The Atiyah–Jones conjecture for rational surfaces*, Séminaire de Géométrie e Singularités, Université de Marseille Province (France), invited by A. Teleman
- 2004 *Symmetries of instanton moduli and applications*, Oberseminar, MPIM-Bonn (Germany), invited by D. Zagier
- 2004 *The Atiyah–Jones conjecture for rational surfaces*, Algebraic Geometry Seminar, MPIM-Bonn (Germany), invited by E. Materov
- 2004 *The Atiyah–Jones conjecture for rational surfaces*, Algebraic Geometry seminar, Cambridge University (England), invited by B. Totaro
- 2003 *Two applications of instanton numbers*, Southern California Algebraic Geometry Meeting, UC Riverside (USA), invited by L. Katzarkov
- 2003 *The Atiyah–Jones conjecture for rational surfaces* UC Irvine (USA), invited by L. Katzarkov
- 2003 *The Atiyah–Jones conjecture for rational surfaces*, University of Texas at Austin (USA), invited by D. Freed
- 2003 *Moduli of bundles and birational transformations*, University of Porto (Portugal), Conference on Vector Bundles on Algebraic Curves, invited by P. Gothen
- 2003 *Two applications of instanton numbers* University of Lisbon (Portugal), invited by M. Mendez-Lopes
- 2003 *Moduli of bundles on surfaces and birational transformations* Stanford University (USA), invited by R. Cohen
- 2003 *Moduli of vector bundles and singularities* University of Texas at Austin (USA), invited by D. Freed
- 2002 *Moduli of bundles on surfaces and birational transformations* Warwick University (England), Cambridge-Oxford-Warwick joint seminar, invited by M. Reid
- 2002 *Moduli of bundles on blown-up surfaces* University of Constanța (Romania) Conference on Algebraic Geometry, Commutative Algebra and Topology, invited by V. Brinzanescu

- 2002 *Moduli spaces and curve singularities* Isaac Newton Institute for Mathematics, Cambridge (England) High Dimensional Geometry Program, invited by G. Brown
- 2002 *Moduli of bundles on surfaces and birational transformations* University of Texas at Austin (USA), Global Analysis and Differential Geometry Seminar, invited by D. Freed
- 2002 *Instanton invariants of curve singularities* University of Columbia-Missouri (USA), Conference on Hilbert Schemes, Vector Bundles and their Interplay with Representation Theory, invited by Z. Qin
- 2001 *Vector bundles and curve singularities* The International Centre for Theoretical Physics, Trieste (Italy) Summer school on Algebraic Geometry, invited by L. Göetsche
- 2001 *Instanton and Curve Singularities* School on Relativity and Gravitational Physics Como (Italy)
- 2001 *Holomorphic bundles on blown-up surfaces* Cambridge University (England), Algebraic Geometry Seminar invited by B. Totaro
- 2001 *Instanton charges as invariants of curve singularities* Stanford University (USA), Summer Symposium on Moduli Spaces Invited by R. Cohen
- 2001 *Holomorphic bundles on blow-ups* University of Texas at Austin (USA), Global Analysis and Differential Geometry Seminar, invited by K. Uhlenbeck
- 2001 *Numerical invariants for bundles on blow-ups* Northern Illinois University (USA), Colloquium, invited by C. Hurlburt
- 2000 *Vector bundles over elliptic fibrations* University of Texas at Austin (USA), String Theory and Geometry Seminar, invited by D. Freed
- 2000 *Vector bundles and curve singularities* Northern Illinois University (USA), Algebraic Geometry Seminar invited by C. Hurlburt
- 2000 *Numerical invariants for bundles on blow-ups* Berkeley University (USA), Algebraic Geometry Seminar, invited by R. Hartshorne
- 2000 *Numerical invariants for bundles on blow-ups* The University of New Mexico (USA), Geometry Seminar, invited by C. Boyer
- 2000 *Instantons on blow-ups* Stanford University (USA), Topology Seminar, invited by R. Cohen
- 2000 *Topologia de espaços de moduli de fibrados* Universidade de Niterói (Brazil), invited by S. Firmo
- 1999 *Fibrados holomorfos sobre blow-ups* IMPA (Brazil) Brazilian Mathematical Meeting, invited by I. Lequain
- 1999 *The classification of rational surfaces* Federal University of Paraná (Brazil) invited by Adonai Sant'anna
- 1998 *Moduli spaces of instantons* The Institute of Mathematical Sciences, Chennai, (India) Physics Seminar, invited by H. S. Sharatchandra
- 1998 *Holomorphic vector bundles on surfaces* Instituto Politecnico di Torino (Italy), Algebraic Geometry Seminar, invited by L. Gatto
- 1998 *Fibrados vetoriais e modulos finitamente gerados* UNICAMP(Brazil) Brazilian meeting of algebraic geometry, invited by I. Vainsencher

- 1997 *Numerical invariants for bundles on blow-ups* SPIC mathematical institute, Chennai (India), algebraic geometry seminar, invited by V. Seshadri
- 1997 *GAGA para variedades não compactas* Recife (Brazil) VII meeting of the Brazilian Academy of Sciences, invited by I. Vainsencher
- 1995 *Holomorphic bundles on blow-ups* Instituto de Matemáticas de Guanajuato, Mexico, invited by L. Brambilla-Paz
- 1994 *Fibrados holomórficos sobre blow-ups* Catholic University of Lima (Peru) XXX Anniversary invited by F. Torres
- 1991 *Three topological Invariant Cardinals* State University of São Paulo, Colloquium, invited by O. Alas
- 1990 *Non-reflexive Logics* Aeronautics Technological Institute, Logic and Philosophy São Paulo (Brazil) invited by N. C. A. da Costa
- 1989 *10 properties equivalent to the Axiom of Choice* State University of São Paulo (Brazil) Philosophy seminar invited by N. C. A. da Costa
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