

### Personal

Name Elizabeth Gasparim  
Post Lecturer  
College Science and Engineering  
School Mathematics  
University Edinburgh  
Birth Brazil  
Citizenship Brazilian  
Marital status divorced

### University education

Undergraduate Federal University of Paraná, Brazil, 1989.  
Postgraduate Universidade Estadual de Campinas, 1991.  
The University of New Mexico, USA, 1995.

### Degrees

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

### Career since graduation

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.

### Major research interests

Algebraic Geometry, Mathematical Physics, Algebraic Topology.

### Principal research grants

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.

### RAE status

Included in 2007.

## Small grants and supported visits as an Edinburgh faculty

2007	IHES France - 2 months visit
2007	MPIM Bonn - 1 month visit
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
2009	CIRM Luminy, France - 1 month visit to coordinate research group together with support for collaborators
2009-2010	Royal Society Grant for collaboration with the Physics Institute of the Indian Association for the Cultivation of Science (Kolkotta) together with support for 4 collaborators
2009	FAPESP São Paulo, Brazil - grant for 3 weeks visit
2009	EMS grant for visit by Dr. Wendy Lowen

## Research supervision experience

- Jesus Martinez Garcia - current PhD supervisor (Edinburgh)
- Dmitry Sakovics - current second supervisor (Edinburgh)
- Ciaran Patrick Meachan - current second supervisor (Edinburgh)
- Thomas Köppe - current PhD supervisor (Edinburgh)
- Spiros Adams-Florou - current second supervisor (Edinburgh)
- Rodolfo Estupiñán Allan - postgraduate supervisor 2008 (Unicamp, Brazil)
- Guy Roger Byogman - PhD 2006 (New Mexico State University, USA)
- Jean Bernard Nganou - PhD 2005–2006 (New Mexico State University, USA)
- Lalitha Garimella - second supervisor Masters 2006 (New Mexico State University, USA)
- Zac Harlow - undergraduate research 2006 (New Mexico State University, USA)
- Sandi Tasena - Masters 2004–2005 (New Mexico State University, USA)
- Samantha Kilroy - undergraduate research 2005 (New Mexico State University, USA)
- Megan Lockwood - undergraduate research 2004 (New Mexico State University, USA)
- Pablo Gustavo Braz e Silva - 2003 Pos-doctoral studies (International Centre for Theoretical Physics, Italy)
- Antonio Carlos Pereira de Souza - 2000 Masters (Federal University of Pernambuco, Brazil)

## Teaching Experience

Algebraic Geometry, Algebraic Topology, Riemann Surfaces, Discrete Mathematics, Ordinary Differential Equations, Linear Algebra with Applications, Topics in Differential Geometry, Topology, Complex Analysis, Real Analysis, Business Calculus, Calculus I, II, III, Advanced Calculus, Algebra, Probability, Applicable Mathematics 3, Mathematics for Informatics 2, 3. Minicourses: Summer School on Riemann Surfaces (Brazil), Sheaf Cohomology and Mathematical Physics (India).

## Administrative experience

- 2008–to date      Library Liason 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 Advisor for WISE (Women in Science and Engineering) for the College of Arts and Sciences at New Mexico State University, USA.
- 1999              Head of department, Federal University of Pernambuco, Brazil.

## Society Membership

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

## Committee Membership

- 2008–to date      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: 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, and Mathematische Zeitschrift.

## National invitations

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

- 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.
- 2006              Stanford University, USA.
- 2004              Cambridge University, England.
- 2007, 2005,      Max Planck Institut für Mathematik, Bonn, Germany.  
2004
- 2003              Kavli Institute for theoretical Physics, UC Santa Barbara, USA.
- 2002              The Isaac Newton Institute, England.
- 2000              Stanford University, USA.
- 2001, 2000,      International Centre for Theoretical Physics, Italy.  
1999, 1996
- 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.

## Selected Invited Talks

- 2009 *Level-rank duality*, Workshop in algebraic geometry and physics, Maresias (Brasil), 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, Vecto 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 ar 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

### Appointments as external examiner

Five postgraduate examinations for students in mathematics, physics and electrical engineering at NMSU (USA) during 2004–2006.

### Conference and Seminar Organization

2008- to date Topology seminar – University of Edinburgh (jointly with Andrew Ranicki)

Currently I am organizing:

- Hodge theoretical reflexions on the string landscape, to be held at ICMS Edinburgh, June 2010 (jointly with D. Freed and T. Pantev)
- Second Latin Congress on Symmetries in Geometry and Physics, to be held in Curitiba, Brazil, December 2010 (jointly with D. Kaledin, E. Hoefel and M. Jardim)

Previous	conferences I organized:
2008	<i>First Cuban Congress on Symmetries in Geometry and Physics</i> , Havana, Cuba, (jointly with D. Kaledin)
2007	Research Seminar for the <i>Program for Women in Mathematics</i> at the IAS in Princeton

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SELECTED TRACK RECORD  
IN ALGEBRAIC GEOMETRY AND MATHEMATICAL PHYSICS

Elizabeth Gasparim

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### **$\iota$ ) 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  $X$ ? 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.

### **$\upsilon$ ) 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  $\mathbb{C}^2$  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.

### **$\upsilon\upsilon$ ) 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. I generalised these results, proving that the Atiyah–Jones conjecture holds true 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. The remaining cases of the conjecture are still open.

### **$\upsilon\upsilon$ ) 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/>.

### $\nu$ ) 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.

### $\nu\iota$ ) 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.

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PUBLICATIONS

Elizabeth Gasparim

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#### Published articles

1. *The Nekrasov conjecture for toric surfaces*, with Melissa Liu, to appear in *Comm. Math. Phys.*
2. *Smoothing of rational  $m$ -ropes*, with E. Ballico and T. Köppe, to appear in *Cent. Eur. J. Math.*
3. *Local moduli of holomorphic bundles*, with E. Ballico and T. Köppe, *J. Pure Appl. Algebra* **213**, 397–408 (2009).
4. *Vector bundles near negative curves: moduli and local Euler characteristic*, with E. Ballico and T. Köppe. *Comm. Algebra* **37** no. 8, 2688–2713 (2009).
5. *The Atiyah–Jones conjecture for rational surfaces*, *Advances Math.* **218**, 1027–1050 (2008).
6. *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).
7. *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).
8. *Three applications of instanton numbers*, with P. Ontaneda, *Comm. Math. Phys.* **270**, no. 1, 1–12 (2007).

9. *Computing instanton numbers of curve singularities*, with I. Swanson, J. Symbolic Comput. **40**, no. 2, 965–978 (2005).
10. *Vector bundles on a three-dimensional neighborhood of a ruled surface*, with E. Ballico, J. Pure Appl. Algebra **195**, no. 1, 7–19 (2005).
11. *The Atiyah–Jones conjecture for rational surfaces*, with R. J. Milgram, MPIM Bonn preprint, 2004–2014 (2004).
12. *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).
13. *Numerical invariants for bundles on blow-ups*, with E. Ballico, Proc. Amer. Math. Soc. **130**, no. 1, 23–32 (2002).
14. *Two applications of instanton numbers*, Isaac Newton Inst. Preprint Series, no. NI02022-HDG, 1–15 (2002).
15. *Holomorphic vector bundles on holomorphically convex complex surfaces*, with E. Ballico, Matematiche (Catania) **55**, no. 1, 3–15 (2001).
16. *Chern classes of bundles on blown-up surfaces*, Comm. Algebra **28**, no. 10, 4919–4926 (2000).
17. *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).
18. *Holomorphic and algebraic vector bundles on  $\theta$ -convex algebraic surfaces*, with E. Ballico, Proc. Indian Acad. Sci. **109**, no. 4, 353–358 (1999).
19. *On the topology of holomorphic bundles*, Bol. Soc. Parana. Mat. **18**, no. 1–2, 1–7 (1998).
20. *Rank two bundles on the blow-up of  $\mathbb{C}^2$* , J. Algebra **199**, no. 2, 581–590 (1998).
21. *Chern classes of bundles over rational surfaces*, Instituto Politecnico di Torino Rapporto Interno **30**, (1998).
22. *Holomorphic bundles on  $\mathcal{O}(-k)$  are algebraic*, Comm. Algebra **25**, no. 9, 3001–3009 (1997).
23. *GAGA para variedades não compactas*, Anais Acad. Bras. Ciências **69**, no. 4 (1997).
24. *Fibrados Holomórficos sobre blow-ups*, XXX Anniversary P.U.C. Peru, Pro-Math. **10**, no. 20 (1996).

## Notes, reviews and review articles

1. Ballico, Edoardo. *Unfiltrable holomorphic vector bundles in a cyclic quotient of  $\mathbb{C}^2$* . Bull. Inst. Math. Acad. Sin. (N.S.) **1**, no. 2, 337–340 (2006). (Reviewer: Elizabeth T. Gasparim) 32L05 (32L10 32S25)
2. Barth, Wolf P. and Rams, Sawomir. *Equations of low-degree projective surfaces with three-divisible sets of cusps*. Math. Z. **249**, no. 2, 283–295 (2005). (Reviewer: Elizabeth T. Gasparim) 14J25 (14J17)
3. Mukai, Shigeru. *Plane quartics and Fano threefolds of genus twelve*. The Fano Conference, 563–572, Univ. Torino, Turin, 2004. (Reviewer: Elizabeth T. Gasparim) 14J45 (14H50)
4. Zhou, Xiang Yu and Liu, Wei Ming. *Holomorphic vector bundle on Hopf manifolds with abelian fundamental groups*. Acta Math. Sin. (Engl. Ser.) **20**, no. 4, 605–612 (2004). (Reviewer: Elizabeth T. Gasparim) 32L10 (32J18)

5. Kojima, Hideo. *Rank one log del Pezzo surfaces of index two*. J. Math. Kyoto Univ. **43**, no. 1, 101–123 (2003). (Reviewer: Elizabeth T. Gasparim) 14J26 (14F45 14J17)
6. Ballico, Edoardo. *Continuous homogeneous polynomials and zero-dimensional analytic subsets of infinite-dimensional projective spaces*. Int. J. Pure Appl. Math. **7**, no. 3, 335–338 (2003). (Reviewer: Elizabeth T. Gasparim) 32K99 (46G20)
7. Ballico, Edoardo. *Gâteaux-analytic vector bundles on infinite-dimensional analytic sets*. Int. Math. J. **3**, no. 8, 847–850 (2003). (Reviewer: Elizabeth T. Gasparim) 32K05 (46G20)
8. Ballico, Edoardo. *Union of linear spaces in infinite-dimensional projective spaces and holomorphic vector bundles*. Results Math. **43**, no. 3–4, 202–204 (2003). (Reviewer: Elizabeth T. Gasparim) 32K05 (32L05 32L10)
9. Aprodu, Marian, Brinzanescu, Vasile and Toma, Matei. *Holomorphic vector bundles on primary Kodaira surfaces*. Math. Z. **242**, no. 1, 63–73 (2002). (Reviewer: Elizabeth T. Gasparim) 32L05 (32J15)
10. Ballico, Edoardo. *Flat coverings of infinite-dimensional complex projective spaces*. Int. J. Pure Appl. Math. **3**, no. 1, 105–108 (2002). (Reviewer: Elizabeth T. Gasparim) 32K05 (58B12)
11. Karadoğan, Gülay. *On the modular curve  $X(6)$  and surfaces admitting genus 2 fibrations*. Turkish J. Math. **26**, no. 3, 295–304 (2002). (Reviewer: Elizabeth T. Gasparim) 14J15 (14G35 14J29)
12. Vermeire, Peter. *On the regularity of powers of ideal sheaves*. Compositio Math. **131**, no. 2, 161–172 (2002). (Reviewer: Elizabeth T. Gasparim) 14F17 (14N05)
13. Kasparian, Azniv K. *Fibered surfaces*. Annuaire Univ. Sofia Fac. Math. Inform. **94**, 49–53 (2000, 2001). (Reviewer: Elizabeth T. Gasparim) 32J27 (14E20)
14. Zhou, Chaohui and Chen, Zhihua. *A remark on Steinness*. Chin. Ann. Math., Ser. B **28**, no. 2, 161–164 (2007). (Reviewer: Elizabeth T. Gasparim) 32E10 (32Q05)
15. Troyanov, Marc. *On the moduli space of singular Euclidean surfaces*. Papadopoulos, Athanase (ed.), Handbook of Teichmüller theory. Volume I. Zürich: European Mathematical Society (EMS). IRMA Lectures in Mathematics and Theoretical Physics 11, 507–540 (2007). (Reviewer: Elizabeth T. Gasparim) 32G15 32G13
16. Ballico, Edoardo. *Unfiltrable holomorphic vector bundles in a cyclic quotient of  $\mathbb{C}^2 \setminus \{0\}$* . Bull. Inst. Math., Acad. Sin. (N.S.) **1**, no. 2, 337–340 (2006). (Reviewer: Elizabeth T. Gasparim) 32L05 32L10 32S05
17. Forstneric, Franc. *Holomorphic submersions from Stein manifolds*. Ann. Inst. Fourier **54**, no. 6, 1913–1942 (2004). (Reviewer: Elizabeth T. Gasparim) 32E10 32E30 32H02
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## Articles in progress

1. *Rank-level dualities for local Calabi-Yaus*, with Melissa Liu.
  2. *Derived categories of sheaves on local threefolds*, with Thomas Köppe.
  3. *Homological Mirror Symmetry via  $B$ -side dimensional reduction*, with Patrick Clarke.
  4. *Vertex algebra structures on local moduli.*
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