



**Center for Mathematical Analysis,  
Geometry, and Dynamical Systems**

# **Report 2010**

March 2011

## Conteúdo

<b>1</b>	<b>Research Projects and Special Grants</b>	<b>3</b>
<b>2</b>	<b>Visitors</b>	<b>9</b>
<b>3</b>	<b>Seminar Series &amp; Working Seminars</b>	<b>12</b>
3.1	Analysis, Geometry, and Dynamical Systems Seminar . . . . .	12
3.2	Algebra Seminar . . . . .	13
3.3	Algebraic Geometry / Moduli Seminar . . . . .	14
3.4	Geometria em Lisboa Seminar . . . . .	14
3.5	Partial Differential Equations Seminar . . . . .	15
3.6	String Theory Seminar . . . . .	17
3.7	Topological Quantum Field Theory Club . . . . .	18
3.8	Working Seminar on Contact/Symplectic Topology/Geometry	19
<b>4</b>	<b>Conferences and short courses</b>	<b>19</b>
<b>5</b>	<b>Seminars and lectures by Center members</b>	<b>24</b>
<b>6</b>	<b>Postdoctoral program and research fellows</b>	<b>32</b>
<b>7</b>	<b>Doctoral supervision</b>	<b>35</b>
<b>8</b>	<b>Publications in 2010</b>	<b>35</b>
8.1	Publications which appeared in 2010 . . . . .	35
8.2	Accepted publications (submitted or accepted in 2010) . . . . .	41
8.3	Preprints submitted in 2010 (not yet accepted) . . . . .	44
<b>9</b>	<b>Partnership and outreach</b>	<b>45</b>
<b>10</b>	<b>Personal notes</b>	<b>46</b>

# 1 Research Projects and Special Grants

The following research projects were coordinated by members of the Center in 2010:

## **Algebraic Geometry in Portugal**

(Started 25/1/2010, duration 36 months)

*Funding agency:* Fundação para a Ciência e a Tecnologia

*Reference:* PTDC/MAT/099275/2008

*Principal investigator:* Margarida Mendes Lopes

*Number of participants:* 14

*Budget:* 105.000 €

This project aims to promote the interaction between algebraic geometers in Portugal and is focused on problems linked to moduli spaces and classification of objects of algebraic geometry.

## **Algebraic geometry of moduli spaces**

(Started July 1, 2010, duration 24 months)

*Funding agency:* Seventh Framework Programme (FP7), European Union

*Reference:* 251974 Marie-Curie-FP7-People-2009-IIF

*Contact person:* Rui Loja Fernandes

*Fellow:* Rahul Pandharipande

*Budget:* 205.000 €

The central questions attacked concern cohomology, Virasoro constraints, and map/sheaf equivalences. The methods used are new localization/degeneration techniques related to the virtual classes of the corresponding moduli questions. The project, while in pure mathematics, is related also to topological string theory. The research program will be pursued with mathematicians in the geometry group at the Instituto Superior Técnico in Lisbon and collaborators across Europe.

### **Gulbenkian Mid-career fellowship**

(Started July 1, 2010, duration 48 months)

*Funding agency:* Gulbenkian Foundation

*Reference:* 2501 - Matemática-Presidência

*Contact person:* Rui Loja Fernandes

*Fellow:* Rahul Pandharipande

*Budget:* 160.000 €

### **Applied Mathematics: from Dynamical Systems to Cryptography**

(Started September 1, 2009, duration 48 months)

*Funding agency:* Fundação para a Ciência e a Tecnologia & UT Austin

*Reference:* UTAustin/MAT/0057/2008

*Principal investigator:* Diogo Gomes

*Number of participants:* 28

*Budget:* 100.000 €

In this project we bring together researchers from several areas in Applied Mathematics including Dynamical Systems, Financial Mathematics, Game Theory, Optimal Control, Viscosity Solutions, Number Theory, and Cryptography. In all these areas there are strong research groups both in Portuguese Universities as well as in the University of Texas at Austin. The UTAustin—Portugal initiative presents a unique opportunity to foster scientific interactions between groups in Portugal and UT Austin.

### **Black Holes, Duality and String Theory**

(Started 24/6/2010, duration 12 months)

*Funding agency:* Fundação para a Ciência e a Tecnologia & Deutscher Akademischer Auslandsdienst (DAAD)

*Reference:* Transnational Cooperation grant FCT/DAAD 2010-2011

*Principal investigator:* Gabriel Lopes Cardoso

*Number of participants:* 10

*Budget:* 3.000 €

This project studies various aspects of duality in string theory that include the interplay between mirror symmetry and geometric transitions, and attractors and the fluid-gravity correspondence.

### **CMU — Portugal: ICTI Program in Applied Mathematics**

*Funding agency:* Fundação para a Ciência e a Tecnologia

*Director:* Diogo Gomes

The Center for Mathematical Analysis, Geometry, and Dynamical Systems is one of the participating research units in this cooperation program between portuguese institutions and Carnegie Mellon University.

<http://icti.math.cmu.edu/>

### **CoLab Program UT Austin — Portugal**

*Funding agency:* Fundação para a Ciência e a Tecnologia

*Director:* Diogo Gomes

The Center for Mathematical Analysis, Geometry, and Dynamical Systems is one of the participating research units in this cooperation program between portuguese institutions and University of Texas at Austin.

<http://math.utaustinportugal.org/>

### **Contact and symplectic topology**

(Started January 27, 2010, duration 60 months)

*Funding agency:* European Science Foundation (Research Networking Programme)

*Reference:* CAST

*Member of Steering Committee in Portugal:* Sílvia Anjos

*Other Members in the Steering Committee:* Frédéric Bourgeois – Programme Chair, Vincent Colin, Kai Cieliebak, András Stipsicz, Michael Entov, Paolo Lisca, Robert Vandervorst, Aleksy Tralle, Francisco Presas, Tobias Ekholm, Felix Schlenk, Ivan Smith

*Budget:* 475.000 €

The goal of this network is to stimulate exchange between researchers from all branches of contact and symplectic topology, in order to create a comprehensive perspective on the field and make progress on some of the basic open questions. The European scale of the network reflects the global nature

of these questions as well as the European strength in the subject. The planned activities include workshops, research collaborations, and the exchange of PhD students and postdocs.

The research themes of CAST include: Fukaya categories and mirror symmetry, Floer homology and Hamiltonian dynamics, Symplectic field theory, Contact Topology, Complex geometry and Stein manifolds, Topology of symplectic manifolds, Groups of symplectomorphisms and contactomorphisms. <http://cast.ulb.ac.be/>

### **New Geometry and Topology**

(Started 1/1/2010, duration 36 months)

*Funding agency:* Fundação para a Ciência e a Tecnologia

*Reference:* PTDC/MAT/101503/2008

*Principal investigator:* Roger Picken

*Number of participants:* 11

*Budget:* 120.000 €

This project addresses questions in new areas of geometry and topology, including Khovanov homology, the categorification of quantum groups, parallel transport for abelian and non-abelian gerbes, invariants of knots and knotted surfaces, and questions related to quantum gravity.

### **Nonperturbative String Theory and Black Holes at LHC**

(Started 2/2/2010, duration 12 months)

*Funding agency:* Fundação para a Ciência e a Tecnologia

*Reference:* CERN/FP/109344/2009

*Principal investigator:* Ricardo Schiappa

*Number of participants:* 9

*Budget:* 10.000 €

This project is divided into two tasks, respectively addressing nonperturbative partition functions and quantization, and black holes and string theory.

## **Poisson Geometry and Applications**

(Started 1/3/2010, duration 24 months)

*Funding agency:* Fundação para a Ciência e a Tecnologia/GRICES and Centre National de la Recherche Scientifique

*Reference:* 4.1.3/CAPES/CPLP

*Principal investigator:* Rui Loja Fernandes

*Number of participants:* 5

*Budget:* 5.700 €

Cooperation project involving researchers from CAMGSD, Coimbra University and University of Poitiers, in the area of Poisson geometry.

## **Quantum Geometry and Quantum Gravity**

(Started July, 2006, duration 60 months)

*Funding agency:* European Science Foundation (Research Networking Programme)

*Reference:* QG

*Member of Steering Committee in Portugal:* Roger Picken

*Other Members in the Steering Committee:* Harald Grosse, Glenn Barnich, Larisa Jonke, Hermann Nicolai, Jerzy Lewandowski, Victor Aldaya, Ingemar Bengtsson, Juerg Froehlich, John Barrett (Chair), Thomas Thiemann, Carlo Rovelli, Mauro Carfora

*Budget:* 568.541 €

The research programme will study several approaches to quantum gravity, namely loop quantum gravity, spin foam models, dynamical triangulations and matrix models. The common theme is the occurrence of quantum geometry in all these approaches. The research programme will study mathematical tools and techniques in non-commutative geometry and quantum groups and their applications to quantum gravity.

<http://www.maths.nottingham.ac.uk/qg/>

## **Research Chair in String Theory**

(started 01/10/2009, duration 60 months)

*Funding agency:* Fundação para a Ciência e a Tecnologia and IST

*Researcher:* Gabriel Lopes Cardoso

*External Budget:* 150.000 €

Gabriel Lopes Cardoso holds the Invited Research Chair on Mathematical Physics & String Theory. The main research goals are in the area of String Theory, with very strong links to Mathematical Physics, Geometry and Topology. This is a most promising venue for future research, lying at the interface between Mathematics and Theoretical Physics, and with proven major contributions to both fields.

<http://alfa.fct.mctes.pt/apoios/outros/catedras/index.phtml.en>

## **Symplectic and Related Geometries**

(Started 1/2/2010, duration 36 months)

*Funding agency:* Fundação para a Ciência e a Tecnologia

*Reference:* PTDC/MAT/098936/2008

*Principal investigator:* Rui Loja Fernandes

*Number of participants:* 10

*Budget:* 122.000 €

Research project in symplectic geometry and related subjects. It provides funding for post-doctoral grants and junior research grants.

## **Symplectic Geometry and Generalizations**

(Started 1/7/2008, concluded 31/8/2010)

*Funding agency:* Fundação para a Ciência e a Tecnologia/GRICES e Ministério da Educação do Brasil/CAPES

*Reference:* 4.1.3/CAPES/CPLP

*Principal investigator:* Rui Loja Fernandes

*Number of participants:* 4

*Budget:* 9.000 €

Cooperation project involving researchers from CAMGSD, the Univ. Federal do Rio de Janeiro, and IMPA, in the area of symplectic geometry.



## **Topological Aspects of Symplectic Geometry and Its Generalizations**

(Started 1/7/2008, concluded 31/08/2010)

*Funding agency:* Fundação para a Ciência e a Tecnologia/GRICES e Spanish National Research Council (CSIC)

*Reference:* 14/CSIC/08 2008/2009

*Principal investigator:* Rui Loja Fernandes

*Number of participants:* 4

*Budget:* 3.640 €

Cooperation project involving researchers from CAMGSD and from CSIC-Madrid in the area of symplectic geometry and topology and their generalizations.

## **2 Visitors**

The following researchers visited the Center in 2010:

Aaron Pixton, Princeton Univ., 18.10.2010

Abdò Roig-Maranges, Univ. Politècnica de Catalunya, Spain, 23.11.2010

Alina Marian, Univ. Illinois at Chicago, USA, 17.12.2010

Andrea Bruno, Univ. di Roma III, 08.11.2010

Anton Alekseev, Geneva Univ., 01–07.12.2010

Antonio Rieser, Univ. Montreal, Canada, 08–13.06.2010

Artur Lopes, Univ. Federal do Rio Grande do Sul, Brasil, 06–23.09.2010

Bernard de Wit, Univ. Utrecht, The Netherlands, 01–13.05.2010

Bernold Fiedler, Freie Univ. Berlin, Germany, 12.02.2010–05.03.2010

Björn Gohla, Porto Univ.,

Bjorn Poonen, Massachusetts Inst. Technology, USA, 11–14.07.2010

Boyan Sirakov, L'École des Hautes Études en Sciences Sociales, France, 11–18.04.2010

Brian Hall, Univ. of Notre Dame, USA, 15–25.05.2010

Carel Faber, KTH Stockholm, 15.09.2010

Carlos Herdeiro, Univ. Porto, 28–30.03.2010

Charlotte Kristjansen, Niels Bohr Inst., 07–09.11.2010

Christopher Woodward, Rutgers Univ., USA, 20–23.06.2010  
Ciro Ciliberto, Univ. degli Studi di Roma Tor Vergata, Italy, 15–20.03.2010  
David Evans, Cardiff Univ., 15–17.12.2010  
Edgard Pimentel, Univ. São Paulo, Brasil, 15.02.2010–16.03.2010  
Eduardo Esteves, Inst. Nacional de Matemática Pura e Aplicada, Brasil, 31.01.2010–07.02.2010  
Elivira Zappale, Univ. di Salerno, 15.7.2010  
Enrico Valdinoci, Univ. di Roma Tor Vergata, Italy, 15.05.2010  
Elismar Oliveira, Univ. Federal do Rio Grande do Sul, Brasil, 01–23.01.2010  
Eva Miranda, Univ. Politècnica de Catalunya, Spain, 08–12.02.2010  
Florin-Ovidiu Dumitrescu, Max Planck Inst., Germany, 19–23.07.2010  
Geordie Thomas Williamson, Univ. Oxford, UK, 12–24.07.2010  
Georgios Kostakis, Univ. Crete, Greece, 14–20.03.2010  
Gian Pietro Pirola, Univ. de Pavia, 13–21.06.2010  
Gianguido Dall’Agata, Inst. Nazionale di Fisica Nucleare, Italy, 02–05.05.2010  
Ivan Kostov, Inst. Physique Théorique, France, 07–16.04.2010  
Ivan Smith, Univ. Cambridge, 27.8.2010  
Ivan Struchiner, Univ. Utrecht, The Netherlands, 26.02.2010–04.03.2010  
James Lewis, Univ. Alberta, 23.9.2010  
Jan Weidner, Univ. Freiburg, 12–24.07.2010  
Javier Elizondo, Univ. Nacional Autónoma de México, 05–11.07.2010  
Joana Mohr, Univ. Federal do Rio Grande do Sul, 04.02.2010  
Joana Oliveira dos Santos, Univ. Paris Dauphine, 08.06.2010  
João Baptista, Univ. Amsterdam, The Netherlands, 12.07.2010  
Jorge Vitória, Univ. Warwick, 14.07.2010  
Josep Cayuela, Inst. Biología Molecular y Celular de Plantas, Spain, 26.03.2010–02.05.11  
Joseph Grant, Univ. Bristol, UK, 12–24.07.2010  
Julio Rossi, Univ. Alicante, Spain, 18.03.2010–18.04.2010  
Leonardo Macarini Inst. Nacional de Matemática Pura e Aplicada, Brasil, 01.05.2010–04-06-10  
Leonid Checkhov, Steklov Mathematical Inst., Russia, 25–30.04.2010  
Leticia Brambila Paz, CIMAT, Guanajuato, Mexico, 14–25.06.2010  
Lino Amorim, Univ. Wisconsin-Madison, USA, 09–12.06.2010

Lotte Hollands, California Inst. Technology, USA, 06–28.06.2010  
Louis-Hadrien Robert Inst. Mathématique de Jussieu, France, 12–24.07.2010  
Lúcia Caporaso, Univ. di Roma III, Italia, 31.01.2010–05.02.2010  
Magdalena Larfors, LMU Munich, 3–12.10.2010  
Mahendra Panthee, Univ. Minho, 20–23.12.2010  
Manuel de León, ICMAT–CSIC, Spain, 07.12.2010  
Marco Barchiesi, Basque Center for Applied Mathematics, Spain, 25.03.2010  
Marco Mazzucchelli, Max Planck Inst., Germany, 09–12.06.2010  
Mark Gross, Univ. California, USA, 19–27.06.2010  
Martin Burns, Univ. Strathclyde, UK, 06–12.05.2010  
Matteo Novaga, Univ. degli Studi di Padova, Italy, 05–09.07.2010  
Maxime Kontsevitch, Inst. Hautes Études Scientifiques, France, 05–07.07.2010  
Michael Grinfeld, Univ. Strathclyde, UK, 02–15.05.2010  
Nicola Fusco, Univ. degli Studi di Napoli Federico II, Italy, 14–28.03.2010  
Nicolas I. Libedinsky Silva, Univ. Paris, France, 12–24.07.2010  
Niclas Wyllard, 15.05.2010–02.06.2010  
Nitu Kitchloo, Univ. California San Diego, 01.07.2010  
Noah Kieserman, Bowdoin Coll., USA, 07–12.01.2010  
Orfeu Bertolami, Porto Univ., 20.9.2010  
Paul Johnson, Imperial College, UK, 06.12.2010  
Pedro Salomão, IME/USP, 07.12.2010  
Peter Newstead, Univ. Liverpool, 12–25/06/10  
Rachid El Harti, Univ. Hassan I, Morocco, 12.01.2010  
Rafael Rigão Sousa, Univ. Federal do Rio Grande do Sul, 28.01.2010  
Reza Rezazzadegan, Aarhus Univ., Denmark, 12–24.07.2010  
Rita Pardini, Univ. di Pisa, Italy, 11–19.06.2010  
Rutger Boels, Univ. Hamburgo, Germany, 30.05.2010–01.06.2010  
Ryan Hynd, Univ. California, Berkeley, USA, 01–08.07.2010  
Saber Elaydi, Trinity Univ., San Antonio, Texas, USA, 09–26.05.2010  
Sara Pasquetti, CERN, Switzerland, 25–30.04.2010  
Sean Lawton, Univ. Texas Pan American, USA, 14–23.06.2010  
Silvia Sabatini, École Polytechnique Fédérale de Lausanne, Switzerland, 10–14.01.2010

Stefan Vandoren, Univ. Utrecht, The Netherlands, 12–15.06.2010

Suresh Nampuri, LMU Munich, 14–26.11.2010

Vicente Munoz, Univ. Complutense, Spain, 22–25.06.2010

Vivek Shende, Princeton Univ., 01.02.2010–31.07.2010

Yaim Cooper, Princeton Univ., 01.09.2010–30.06.2011

### 3 Seminar Series & Working Seminars

#### 3.1 Analysis, Geometry, and Dynamical Systems Seminar

This is the main seminar of the Center. It included the following talks in 2010:

- Manuel de León (ICMAT-Consejo Superior de Investigaciones Científicas), Generalized Hamiltonian systems and applications to nonholonomic mechanics, 7/12/10.
- Joana Oliveira dos Santos (Univ. Paris Dauphine), A geometric definition of the Aubry-Mather set, 8/6/10.
- Enrico Valdinoci (Univ. di Roma Tor Vergata), Geometric properties of elliptic PDEs arising from a variational problem, 18/5/10.
- Saber Elaydi, (Trinity Univ. San Antonio, Texas), Invariant Manifolds in Competition Models, 18/5/10.
- Martin Burns, (Univ. Strathclyde, Glasgow), Steady state solutions for a quasilinearparabolic bistable equation, 7/5/10.
- Michael Grinfeld, (Univ. Strathclyde, Glasgow), Modelling submonolayer deposition, 6/5/10.
- Josep Sardanyés, (Complex Systems Lab-Universitat Pompeu Fabra, Barcelona), Error threshold in RNA quasispecies models with complementation, 30/3/10.
- Georgios Costakis, (Univ. Creta), Dynamics of linear operators: hypercyclicity and local hypercyclicity, 16/3/10.
- Bernold Fiedler, (Freie Universität Berlin), Assembling Some Low Dimensional Sturm Attractors, 2/3/10.
- Rachid El Harti, (Univ. Hassan I, Morocco), Thompson group and Dixmier problem, 12/1/10.

<http://sem.math.ist.utl.pt/cam/arquivo>

## 3.2 Algebra Seminar

This included the following talks in 2010:

- Abdó Roig-Maranges (Universitat Politècnica de Catalunya), Morphic cohomology of toric varieties, 23/11/10.
- James Lewis (University of Alberta), An Archimedean height pairing on the equivalence relation defining Bloch's higher Chow groups, 23/9/10.
- James Lewis (University of Alberta), New invariants on algebraic cycles, 21/9/10.
- Jorge Vitória (University of Warwick), Equivalences for non-commutative projective spaces, 14/7/10.
- Bjorn Poonen (MIT), Existence of rational points on smooth projective varieties, 12/7/10.
- Javier Elizondo (Universidad Nacional Autónoma de México), The motivic Euler-Chow series, 8/7/10.
- Pedro Martins Rodrigues (IST, CAMGSD), A Profinite Module associated to a hyperbolic toral automorphism, 9/6/10.
- Carlo Rossi (CAMGSD), Formality for two branes and Lie algebras-II, 2/6/10.
- Carlo Rossi (CAMGSD), 2-brane formality and Lie algebras, 26/5/10.
- Marcin Szamutolski (IST), Galois theory of Hopf-Galois extensions, 15/4/10.
- Joana Ventura (IST, CAMGSD), Reduced and tame fusion systems, 17/3/10.
- João Boavida (IST),  $O(n)$  periods of Eisenstein series on  $O(n, 1)$ , 3/3/10.
- João Boavida (IST), Quadratic forms and the structure of orthogonal groups, 18/2/10.
- Rachid el Harti (Hassan I University, Morocco), Projective limits of  $C^*$ -algebras, 26/1/10.
- Gonçalo Tabuada (Universidade Nova de Lisboa), Non-commutative motives, 14/1/10.

<http://sem.math.ist.utl.pt/algebra/arquivo>

### 3.3 Algebraic Geometry / Moduli Seminar

This included the following talks in 2010:

- Alina Marian, (Univ. Illinois at Chicago), Verlinde Relations in the Tautological Ring of  $\mathcal{M}_g$ , 17/12/10.
- Paul Johnson, (Imperial College, UK), Polynomiality and Hurwitz Numbers, 6/12/10.
- Rahul Pandharipande, (Princeton Univ.), Hilbert schemes II, 19/11/10.
- Andrea Bruno, (Univ. di Roma III), On the automorphism group of  $\mathcal{M}_{0,n}$ , 8/11/10.
- Yaim Cooper, (Princeton Univ.), The geometry of stable quotients in genus 1, 25/10/10.
- Aaron Pixton, (Princeton Univ.), Rationality of the stable pairs vertex, 18/10/10.
- Rahul Pandharipande, (Princeton Univ.), Hilbert schemes I, 4/10/10.
- Carel Faber, (KTH Stockholm), Cohomology of the the moduli space of curves via point counting, 15/9/10.
- Ivan Smith, (Univ. Cambridge), Quadrics, 3-manifolds and Floer cohomology, 27/8/10.

<http://sem.math.ist.utl.pt/algeomod/arquivo>

### 3.4 Geometria em Lisboa Seminar

This included the following talks in 2010:

- Pedro Salomão, (IME/USP), Global properties of closed geodesics on the 2-sphere, 7/12/10.
- Rémi Leclercq, (IST), Homological "stability" of weakly exact Lagrangians, 2/11/10.
- Éveline Legendre, (IST), Non-uniqueness of Sasaki toric metrics having constant scalar curvature, 26/10/10.
- João Baptista, (Univ. of Amsterdam), Vortex moduli spaces and their natural metrics, 12/7/10.
- Nitu Kitchloo, (Univ. California San Diego), The 2-dimensional cobordism category with flat connections, 1/7/10.

- Leticia Brambila Paz, (CIMAT, Guanajuato), Generalization of Hecke curves, 22/6/10.
- Lucio Cirio, (GFMUL), The Quantum Cartan Algebra associated to a bicovariant differential calculus, 25/5/10.
- Brian Hall, (Univ. Notre Dame), Berezin-Toeplitz quantization on Lie groups, 18/5/10.
- Leonardo Macarini, (Univ. Federal do Rio de Janeiro), Cylindrical contact homology of even contact forms, 11/5/10.
- José Natário, (IST), An elementary derivation of the Montgomery phase formula for the Euler top, 27/4/10.
- Carlo Rossi, (IST), Deformation quantization via generators and relations, 30/3/10.
- Ciro Ciliberto, (Univ. Roma Tor Vergata), Gaussian maps for curves, 16/3/10.
- Eva Miranda, (Univ. Politècnica de Catalunya), Symplectic and Poisson geometry of b-manifolds, 9/2/10.
- Noah Kieserman, (Bowdoin College), The Liouville Phenomenon in the Deformation of Coisotropic Submanifolds, 12/1/10.

<http://sem.math.ist.utl.pt/geolis/arquivo>

### 3.5 Partial Differential Equations Seminar

This included the following talks in 2010:

- Elivira Zappale (Università di Salerno), Dimensional reduction for supremal functionals, 15/7/10.
- Matteo Novaga (University of Padova), Evolution of a relativistic string., 8/7/10.
- Ryan Hynd (UC Berkeley), The eigenvalue problem of singular ergodic control, 5/7/10.
- Julio Rossi (Universidad de Alicante), Asymptotic behaviour for non-local diffusion problems - II, 16/4/10.
- Boyan Sirakov (Université de Paris X), Fundamental solutions and Liouville results for fully nonlinear elliptic equations, 15/4/10.

- Julio Rossi (Universidad de Alicante), Asymptotic behaviour for non-local diffusion problems - I, 14/4/10.
- Nicola Fusco (University of Naples), Equilibrium configurations of epitaxially strained elastic films: regularity and qualitative properties of solutions - VI, 26/3/10.
- Marco Barchiesi (Basque Center for Applied Mathematics), Homogenization on perforated domains in SBV: an alternative approach, 25/3/10.
- Nicola Fusco (University of Naples), Equilibrium configurations of epitaxially strained elastic films: regularity and qualitative properties of solutions - V, 25/3/10.
- Nicola Fusco (University of Naples), Equilibrium configurations of epitaxially strained elastic films: regularity and qualitative properties of solutions - IV, 24/3/10.
- Julio Rossi (Universidad de Alicante), Games that PDE people like to play - II., 22/3/10.
- Julio Rossi (Universidad de Alicante), Games that PDE people like to play - I, 19/3/10.
- Nicola Fusco (University of Naples), Equilibrium configurations of epitaxially strained elastic films: regularity and qualitative properties of solutions - III, 18/3/10.
- Nicola Fusco (University of Naples), Equilibrium configurations of epitaxially strained elastic films: regularity and qualitative properties of solutions - II, 17/3/10.
- Nicola Fusco (University of Naples), Equilibrium configurations of epitaxially strained elastic films: regularity and qualitative properties of solutions - I, 15/3/10.
- Milena Chermisi (IST), Singular perturbation models in phase transitions for second order materials, 11/3/10.
- Elismar Oliveira (Universidade Federal do Rio Grande do Sul), Mather problem for stationary Lagrangians, 18/2/10.
- Mayte Pérez-Llanos (IST), Blow-up for some nonlinear parabolic problems, 11/2/10.
- Joana Mohr (Universidade Federal do Rio Grande do Sul), Wigner Measures and the semi-classical limit to the Aubry-Mather Measure, 4/2/10.



- Rafael Rigão Sousa (Universidade Federal do Rio Grande do Sul), Discrete Mean Field Games, 28/1/10.

<http://sem.math.ist.utl.pt/pde/arquivo>

### 3.6 String Theory Seminar

This included the following talks in 2010:

- Gaetano Bertoldi, Video Talk: From Large N Double Scaling Limits to Non-Critical Superstrings, 13/12/10.
- Anton Alekseev, (Geneva University), Tropical avatar of the Gelfand-Zeitlin integrable system [joint Strings/Geometry seminar], 6/12/10.
- Philip Argyres, Video Talk: Deformations of N=2 superconformal field theories, 29/11/10.
- Suresh Nampuri, (LMU Munich), Forced Fluid dynamics in the fluid-gravity correspondence, 22/11/10.
- Suresh Nampuri, (LMU Munich), Fluid dynamics from an AdS/CFT perspective, 15/11/10.
- Charlotte Kristjansen, (Niels Bohr Institute), Integrability and non-planarity, 8/11/10.
- Nicolas Orantin, (CAMGSD), Gromov-Witten invariants of the resolved conifold and topological recursion, 25/10/10.
- Sebastian Guttenberg, (CAMGSD), Pure Spinor Superspace: on BRST Cohomology, Globality and Holomorphicity, 18/10/10.
- Magdalena Larfors, (LMU Munich), G-structures on smooth complex toric varieties, 11/10/10.
- Magdalena Larfors, (LMU Munich), Flux compactification on manifolds with  $SU(3)$  structure, 4/10/10.
- Kostas Skenderis, Video Talk: The Fuzzball Proposal for Black Holes, 27/9/10.
- Orfeu Bertolami, (Univ. Porto), Noncommutative quantum mechanics, quantum cosmology and black holes, 20/9/10.
- Xi Yin, Video Talk: Counting BPS states on the Quintic, 28/6/10.
- Lotte Hollands, (California Inst. Technology), Vortex counting, surface operators and geometric engineering, 21/6/10.

- Stefan Vandoren, (Utrecht Univ.), Quaternion-Kähler geometry from string theory, 14/6/10.
- Nelia Mann, Video Talk: Connections between Spin-Chain and continuous Integrability in AdS/CFT, 7/6/10.
- Rutger Boels, (Niels Bohr Inst.), On-shell recursion in String theory on the Disc and Sphere, 31/5/10.
- Bernard de Wit, (Univ. Utrecht), BPS black holes and the topological string – a progress report, 10/5/10.
- Gianguido Dall'Agata, (Univ. Padova), Supergravity Dual of 4d CFT's Universal Sector, 3/5/10.
- David Shih, (IAS), Video Talk: Exact Black Hole Degeneracies and the Topological String, 19/4/10.
- Niklas Beisert, Video Talk: Quantizing the spectral curve(s) of AdS/CFT, 5/4/10.
- Carlos Herdeiro, (Univ. Porto), Applying numerical relativity to high energy physics scenarios, 29/3/10.
- Ludwig Faddeev, Video Talk: Discretisation of quantum integrable models, 22/3/10.

<http://sem.math.ist.utl.pt/strings/arquivo>

### 3.7 Topological Quantum Field Theory Club

This included the following talks in 2010:

- Gonçalo Rodrigues (IST), Categorifying Measure Theory II, 15/12/10.
- Björn Gohla (Univ. Porto), Tri-connections and trifunctors, 10/11/10. Support: FCT, CAMGSD, New Geome
- Marco Mackaay (Univ. Algarve), Khovanov and Lauda's diagrammatic calculus for  $sl_n$ , 10/11/10.
- Olivier Brahic (IST), On higher analogues of symplectic fibrations, 10/11/10.
- Gonçalo Rodrigues (IST), Categorifying Measure Theory, 27/10/10.
- Jeffrey Morton (IST), Groupoidification in Physics, 27/10/10.
- Marco Mackaay (Univ. Algarve), Categorifications of Hecke algebras,  $q$ -Schur algebras and quantum groups, 12/10/10.

- Anne-Laure Thiel (IST), Categorification of singular braid monoids and of virtual braid groups, 12/10/10.
- Rui Carpentier (IST), 3-colorings of cubic graphs and operators, 12/10/10.
- Aleksandar Mikovic (Univ. Lusofona, Lisboa), Lie crossed modules and gauge-invariant actions for 2-BF theories, 16/7/10.
- Rafael Diaz (Universidad Sergio Arboleda, Colombia), Categorification, Feynman Integrals, and Quantization - II, 16/7/10.
- Yasuyoshi Yonezawa (Univ. of the Algarve and IST) Quantum  $(sl_n, \wedge V_n)$  link invariant and matrix factorizations., 16/7/10.
- Jeffrey Morton (University of Western Ontario), 2-Linearization, Discrete and Smooth, 15/7/10.
- Rafael Diaz (Universidad Sergio Arboleda, Colombia), Categorification, Feynman Integrals, and Quantization - I, 15/7/10.

<http://sem.math.ist.utl.pt/tqft/arquivo>

### 3.8 Working Seminar on Contact/Symplectic Topology/Geometry

This included the following talks in 2010:

- Stavros Papadakis (CAMGSD), The Enriques-Kodaira classification of complex projective surfaces, four sessions on Feb.09, Feb.18, Mar.02 and Mar.09.
- Rémi Leclercq (CAMGSD), Seidel's morphism, three sessions on Oct.26, Nov.02 and Nov.16.
- Éveline Legendre (NSERC posdoc at IST), Explicit extremal toric Kähler metrics on orbifolds associated to convex quadrilaterals, two sessions on Nov.30 and Dec.14.

## 4 Conferences and short courses

The following Conferences and Short Courses were organized or co-organized by members of the Center in 2010:

### V IST Courses on Algebraic Geometry

*Instituto Superior Técnico, Lisbon, Portugal, February 1–4, 2010*

*Organizer:* Margarida Mendes Lopes.

*Lecturers:*

- Lucia Caporaso (Università di Roma III, Italia)
- Eduardo Esteves (IMPA, Brasil)

<http://www.math.ist.utl.pt/~mmlopes/ISTCOURSES/>

### **CAMGSD Thematic Period: Matrix Models and Geometry**

*Instituto Superior Técnico, Lisbon, Portugal, Spring 2010*

*Organizers:* Gabriel Lopes Cardoso, Ricardo Schiappa, Marcel Vonk.

*Lecturers:*

- Leonid Chekhov (Steklov Moscow)
- Ivan Kostov (CEA-Saclay)
- Sara Pasquetti (CERN)
- Niklas Wyllard (IST)

<http://www.math.ist.utl.pt/~strings/MMG/>

### **GESTA 2010: Symplectic Geometry with Algebraic Techniques**

*Instituto Superior Técnico, Lisbon, Portugal, June 9–12, 2010*

*Scientific Committee:* J. Amorós, M. Fernández, A. Ibort, E. Miranda, I. Mundet, V. Muñoz, F. Presas, I. Sols and C. Tejero.

*Local organizers:* R. L. Fernandes and D. Martínez Torres.

*Invited Lecturers:*

- Miguel Abreu (Instituto Superior Técnico)
- Michael Entov (Technion)
- Viktor Ginzburg (UC Santa Cruz)

*Invited Speakers:*

- Lino Amorim (University of Wisconsin-Madison)
- Alessia Mandini (Instituto Superior Técnico)
- Maksim Maydanskiy (MSRI/University of Cambridge)
- Marco Mazzucchelli (Max Planck Institute)
- Antonio Rieser (University of Montreal)
- Frol Zapolsky (Max Planck Institute)

<http://feat2010.wikidot.com/>

## **Vector Bundles on Algebraic Curves, 2010**

*Instituto Superior Técnico, Lisbon, Portugal, June 14–18, 2010*

*Scientific committee:* Usha Bhosle, Steven Bradlow, Leticia Brambila-Paz, Ugo Bruzzo, Carlos Florentino, Oscar García-Prada, Peter Gothen, Daniel Hernández-Ruipérez, Alastair King, Herbert Lange, Peter Newstead, Christian Pauly, Alexander Schmitt, András Szenes

*Local organization:* Ana Cristina Casimiro, Carlos Florentino, Peter Gothen, Margarida Mendes Lopes, José Mourão, João P. Nunes, Helena Soares

*Main speakers:*

- Kai Behrend (Vancouver, Canada)
- Tom Bridgeland (Sheffield, UK)
- Jim Bryan (Vancouver, Canada)
- Mark Gross (San Diego, USA)
- Dominic Joyce (Oxford, UK)
- Rahul Pandharipande (Princeton, USA)
- Markus Reineke (Wuppertal, Germany)
- Bernd Siebert (Hamburg, Germany)
- Balázs Szendrői (Oxford, UK)

<http://www.vbac2010.net/>

## **XI Lisbon Summer Lectures in Geometry**

*Instituto Superior Técnico, Lisbon, Portugal, June 22–25, 2010*

*Organizing committee:* Carlos Florentino, Leonor Godinho, Margarida Mendes Lopes .

*Lecturers:*

- Vicente Muñoz (Universidad Complutense de Madrid)
- Peter Newstead (University of Liverpool)

<http://www.math.ist.utl.pt/~lgodin/SummerLect10/SummerLect10.html>

## **Trends in Quantum Geometry – Jornada Matemática SPM/CIM**

*Tagus River Cruise July 7, 2010*

*Organizer:* Ricardo Schiappa.

*Special Notes:* With the participation of Maxim Kontsevich

*Plenary speakers:*

- João Baptista (Univ. Amsterdam)
- Michele Cirafici (IST)
- Carlo Rossi (IST)
- Gonçalo Tabuada (Univ. Nova de Lisboa)

[http://www.cim.pt/?q=spm\\_cim\\_jornada\\_Quantum\\_Geometry\\_2010](http://www.cim.pt/?q=spm_cim_jornada_Quantum_Geometry_2010)

## **XIXth Oporto Meeting on Geometry, Topology and Physics**

*Algarve University, Faro, Portugal, July 19–23, 2010*

*Advisory Committee:* Miguel Costa, Carlos Herdeiro, Mikhail Khovanov, Marco Mackaay, José Mourão, Roger Picken and João Nuno Tavares.

*Organizing Committee:* Marco Mackaay, Roger Picken and Pedro Vaz.

*Lecturers:*

- Sabin Cautis (Columbia University)
- Aaron Lauda (Columbia University)
- Catharina Stroppel (Univ. of Bonn)
- Dylan Thurston (Columbia University)
- Ben Webster (MIT)

<http://www.math.ist.utl.pt/~jmourao/om/omgtpix>

## **XIX Fall Workshop on Geometry and Physics**

*Porto University, Portugal, September 6–9, 2010*

*Scientific Committee:* Manuel Asorey, José Adolfo de Azcárraga, Fernando Barbero, Rui Loja Fernandes, Maria Luisa Fernández, Carlos Herdeiro, David Iglesias Ponte, Manuel de León, Giuseppe Marmo, Juan Carlos Marrero, Eduardo Martínez, Miguel Carlos Muñoz-Lecanda, Joana Nunes da Costa, Roger Picken, Cesar Rosales.

*Organizing Committee:* Miguel Costa, Carlos Herdeiro, Filipe Paccetti Correia, Roger Picken, João Nuno Tavares.

*Lecturers:*

- Ingemar Bengtsson (U. Stockholm)
- Philip Candelas (U. Oxford)

*Invited Speakers*

- Andrew Swann (U. Southern Denmark)
- Anna Fino (U. degli Studi di Torino)
- Darryl Holm (Imperial College London, UK)
- Charles Torre (Utah State U.)
- Marcos Mariño (U. Geneva)
- Peter Gothen (U. Porto)
- Sergei Merkulov (U. Stockholm)

<http://cmup.fc.up.pt/cmup/fallworkshop/>

### **3rd Meeting IST - IME Celebrating the 80th Birthday of Waldyr Muniz Oliva**

*Universidade de São Paulo, September 13–17, 2010*

*Scientific Committee:* Luís Barreira, Alexandre N. Carvalho, Paulo D. Cordaro, Giorgio Fusco, Antônio Galves, Luis T. Magalhães, Konstantin Mischaikow, Jacob Palis, Paolo Piccione, Carlos Rocha, Joan Solà-Morales, Jorge Sotomayor, Claudia Valls.

*Local Organizing Committee:* Orlando F. Lopes, Sérgio M. Oliva, Antônio Luiz Pereira, Paolo Piccione, Clodoaldo G. Ragazzo, Gláucio Terra.

<http://www.ime.usp.br/~istime/>

### **Instantons and their moduli space**

*University of Porto, October 22–23, 2010*

*Organization:* Peter Gothen and Margarida Mendes Lopes

*Lecturer:* Rosa M. Miró-Roig

## 5 Seminars and lectures by Center members

The following seminars, invited lectures and short courses have been given by members of the Center:

- Miguel Abreu, Contact and Lagrangian Floer homologies of toric manifolds, Workshop on Symplectic and Contact Topology and Dynamics: Puzzles and Horizons, Mathematical Sciences Research Institute, Berkeley, California, USA, March 22–26, 2010.
- Miguel Abreu, Scalar-flat Kaehler metrics on non-compact toric surfaces, IMAR Seminar, Institute of Mathematics of the Romanian Academy, Bucharest, Romania, April 20, 2010.
- Miguel Abreu, Contact and Lagrangian Floer Homologies of Toric Manifolds, Geometry Seminar, ETH, Zurich, Switzerland, May 31, 2010.
- Miguel Abreu, Contact and Lagrangian Floer homologies of toric manifolds (short course), GESTA 2010 - Symplectic Geometry with Algebraic Techniques, Lisbon, Portugal, June 9–12, 2010.
- Miguel Abreu, Contact Homology of Good Toric Contact Manifolds, Conference Hofer 20 - symplectic geometry and transformation groups, International Centre for Mathematical Sciences, Edinburgh, UK, July 5–9, 2010.
- Miguel Abreu, Contact Homology Computations for Toric Contact Structures on  $S^2 \times S^3$ , Workshop on Symplectic Techniques in Conservative Dynamics, Lorentz Center, Leiden, The Netherlands, August 2–6, 2010.
- Miguel Abreu, Scalar-flat Kähler metrics on non-compact toric 4-manifolds, 3rd IST-IME Meeting, USP, São Paulo, Brasil, Setembro 13–17, 2010.
- Sílvia Anjos, The topology of symplectomorphism groups of some blow-ups of the projective plane, CIRGET 13th Anniversary Reunion Workshop, UQAM, Montréal, Canada, May 10–12, 2010.
- Sílvia Anjos, The topology of symplectomorphism groups of some blow-ups of the projective plane, Workshop on Symplectic Techniques in Conservative Dynamics, Leiden, The Netherlands, August 2–6, 2010.
- Filippo Cagnetti, An extension theorem in  $SBV$ , Universität zu Köln, Germany, February 1, 2010.



- Filippo Cagnetti,  $k$ -quasiconvexity reduces to quasiconvexity, Universidade Nova de Lisboa, March 10, 2010.
- Filippo Cagnetti, Non Convex Aubry-Mather Measures. Centre for Mathematics, University of Coimbra, April 9, 2010.
- Filippo Cagnetti, Decreasing of the Perimeter under Generalized Steiner Symmetrization and Characterization of Cases of Equality, 2010 SIAM Annual Meeting (AN10), Pittsburgh, USA, July 14, 2010.
- Filippo Cagnetti, Stability of the Steiner Symmetrization of Convex Sets. Università degli studi di Napoli Federico II, Napoli, Italy, December 2, 2010.
- Ana Cannas da Silva, Simetria passo a passo, Ciclo de Conferências a Matemática e os seus Encantos, Fundação Gulbenkian, Lisbon, June 23, 2010.
- Ana Cannas da Silva, Folded and unfolded symplectic manifolds, Symplectic Geometry Seminar, ETH, Zurich, October 11, 2010.
- Ana Cannas da Silva, Simetria passo a passo, Colóquio do Centro de Matemática, Univ. Minho, Braga, November 15, 2010.
- Gabriel Lopes Cardoso, BPS Black Holes, the Hesse Potential and the Topological String, ITF Utrecht, The Netherlands, February 5, 2010.
- Gabriel Lopes Cardoso, BPS black holes, the Hesse potential, and the topological string, Iberian Strings 2010, Porto, Portugal, February 10–12, 2010.
- Gabriel Lopes Cardoso, BPS black holes, the Hesse potential, and the topological string, Workshop on Gauge Theories, Supersymmetry and Mathematical Physics, Lyon, France, April 6–10, 2010.
- Gabriel Lopes Cardoso, Classical and Quantum Geometry, UT Austin — Portugal CoLab Event 2010, Gulbenkian Foundation Lisbon, Portugal, September 21, 2010.
- Gabriel Lopes Cardoso, Non-holomorphic deformation of special geometry, III Workshop on Black Holes, Braga, Portugal, December 20–21, 2010.
- Michele Cirafici, Non-perturbative Effects in Calabi–Yau Compactifications, Second Minho Meeting on Mathematical Physics, Minho University, Guimarães, Portugal, November 5, 2010.

- Michele Cirafici, Instantons, Quivers and Noncommutative Donaldson–Thomas Invariants, Rencontres théoricienne, Institut Henri Poincaré, Paris, France, October 7, 2010.
- Michele Cirafici, Quivers and Donaldson–Thomas theory on local threefolds, 3rd Iberian Mathematical Meeting, Braga, Portugal, October 1–3, 2010.
- Michele Cirafici, On Wall Crossing and BPS States, Trends in Quantum Geometry: Jornada Matemática in honour of Maxim Kontsevich, Lisbon, Portugal, July 7, 2010.
- Michele Cirafici, Cohomological Gauge Theory and Donaldson–Thomas Invariants, Vector Bundles on Algebraic Curves 2010 : New Invariants and Stability Conditions, Lisbon, Portugal, June 14–18, 2010.
- Fernando P. Costa, Freedericksz transitions in liquid crystals and bifurcations in pendulum equations, Encuentro UAb-UNED-UOC de Matemáticas, Universidad Nacional de Educación a Distancia, Madrid, Spain, April 2010.
- Fernando P. Costa, Uniqueness of the bifurcating branch in the Freedericksz transition in a liquid crystal cell with weak anchoring, Seminário de Análise e Equações Diferenciais do Centro de Matemática e Aplicações Fundamentais, Universidade de Lisboa, February 2010.
- Fernando P. Costa, Bifurcation analysis of a liquid crystal cell, Summer Meeting on Differential Equations; Celebrating the 70th birthday of Plácido Zoega Táboas, Instituto de Ciências Matemáticas e de Computação, Universidade de São Paulo, São Carlos SP, Brasil, February 2010.
- Carlos Florentino, Geometric quantization of moduli spaces, Discussion Meeting on Geometry and Analysis (short course), Harish Chandra Research Institute, Allahabad, India, January 24–February 10, 2010.
- Carlos Florentino, Geometry, Topology and singularities of moduli spaces of free group representations, Algebra and Geometry Seminar, Univ. Texas Pan American, March 22, 2010.
- Carlos Florentino, Simultaneous similarity and triangularization of sets of 2 by 2 matrices, FCT, Univ. Nova de Lisboa, 28/4/2010.
- Carlos Florentino, Irreducibility and stability of representations of finitely generated groups in reductive groups, Encontro de Algebristas Portugueses, Univ. Beira Interior, Covilhã, September 16–18, 2010.

- Carlos Florentino, Topology and singularities of free group character varieties, Coimbra-Salamanca Algebraic Geometry Seminar, Univ. Salamanca, October 1–2, 2010.
- Pedro Girão, Bifurcation curves of a diffusive logistic equation with harvesting, First Workshop in Mathematical Analysis in Alicante, School of Sciences, Universidad de Alicante, Spain, May 2010.
- Pedro Girão, Bifurcation curves of a diffusive logistic equation with harvesting, Encontro no Douro, Equações Diferenciais e Aplicações, Folgosa do Douro, Armamar, October 2010.
- Diogo Gomes, Aubry-Mather measures for non-convex Hamiltonians, International Conference on Modeling, Optimization and Dynamics Faculdade de Ciências da Universidade do Porto, Portugal, July 2010.
- Diogo Gomes, Non Convex Aubry-Mather Measures Classical and Random Dynamics in Mathematical Physics University of Texas at Austin, Texas, April 2010.
- Gustavo Granja, Realizing modules over the homology of a DGA, Seminário de Álgebra e Combinatória, Universidade de Coimbra, March 2010.
- Gustavo Granja, Topology of symplectomorphism groups, Topology Seminar, IMAR Bucharest, February 2010.
- Sebastian Guttenberg, Pure Spinor Superspace: on BRST Cohomology, Globality and Holomorphicity, String Theory Seminar, IST, October 18, 2010.
- Sharon Hollander, Stable Homotopy Theory and Stacks, Department Colloquium, Ben-Gurion University, Israel, May 2010.
- William D. Kirwin, Adapted complex structures and the geodesic flow, University of Hong Kong, Hong Kong, March 26, 2010.
- William D. Kirwin, Unitarity in quantization commutes with reduction, Semiclassics Seminar, University of Cologne, Germany, November 10, 2010.
- William D. Kirwin, Degenerating complex structures and quantization of toric varieties, Semiclassics Seminar, University of Cologne, Germany, November 17, 2010.
- Rémi Leclercq, Seidel’s morphism and applications, Working Seminar [3 sessions], IST, October and November, 2010.

- Rémi Leclercq, Homological "stability" of weakly exact Lagrangians, Geometria em Lisboa Seminar, IST, November 2, 2010.
- Rémi Leclercq, Homological "stability" of weakly exact Lagrangians, Seminar on Symplectic and Contact Topology, Université Libre de Bruxelles, Belgium, November 4, 2010.
- Éveline Legendre, Explicit resolution of Abreu's equation on quadrilaterals and a test for Donaldson's  $K$ -stability, Université Libre de Bruxelles, Belgium, November 4, 2010.
- Alessia Mandini, Some results on hyperpolygon spaces, Post-doc Seminars, MSRI, University of California, Berkeley, USA, May 3, 2010.
- Alessia Mandini, Some results on hyperpolygon spaces, X GESTA Meeting, Symplectic Geometry with Algebraic Techniques, Lisboa, Portugal, June 9, 2010.
- Alessia Mandini, Some results on hyperpolygon spaces, Encontro Nacional da Sociedade Portuguesa de Matemática 2010, Leiria, Portugal, July 9, 2010.
- David Martínez Torres, Approximately holomorphic techniques in symplectic and related geometries, Invited minicourse (8 hours), Mathematics Department, Universidad de La Laguna, March 2010.
- David Martínez Torres, Universal models for locally conformally symplectic manifolds, 4th Summer School on Geometry, Mechanics and Control, Santiago de Compostela, July 2010.
- David Martínez Torres, Universal models for locally conformally symplectic manifolds, Encontro Nacional da Sociedade Portuguesa de Matemática, Leiria, July 2010.
- David Martínez Torres, Universal models for locally conformally symplectic manifolds, Geometry seminar, Campinas University, July 2010.
- David Martínez Torres, Non-linear symplectic Grassmanians and Hamiltonian actions in prequantum line bundles, G.E.S.T.A. Barcelona-Madrid seminar, Universidad Politécnica de Catalunya, November 2010.
- David Martínez Torres, Non-contractible loops in the diffeomorphism group of coadjoint orbits, Teen seminar, Universidad Politécnica de Catalunya, December 2010.
- José C. Matias, A dimension reduction result in the context of structured deformations, 3rd meeting IST/IME, São Paulo, September 2010.

- Margarida Mendes Lopes, Numerical inequalities for irregular surfaces, Università di Pavia, January 13, 2010.
- Margarida Mendes Lopes, The geography of irregular surfaces, I Meeting of the Coimbra-Salamanca Algebraic Geometry Seminar, Universidade de Coimbra, January 29, 2010.
- Margarida Mendes Lopes, Course Surfaces of general type: geographical and botanical aspects, Winter School on Algebraic Geometry – Algebraic surfaces and related topics, organized by the Korean Institute for Advanced Study and Sogang University, February 2010.
- Margarida Mendes Lopes, On Castelnuovo theorem, Sogang University, Seoul, March 8, 2010.
- Margarida Mendes Lopes, On the existence of certain irregular surfaces, Conference Algebraic Geometry On Varieties And Manifolds, Fudan University, Shanghai, May 11, 2010.
- Jeffrey Morton, Groupoidification in Physics, Tqft club, IST, October 27, 2010.
- Jeffrey Morton, Groupoidification in Physics, Twenty-Second Biennial Meeting of the Philosophy of Science Association, November 4–6, 2010, Montréal, Canada.
- José Mourão, Large complex structure limits in geometric quantization, Plenary talk at the III Iberian Mathematical Meeting, U. Minho, Braga, October 1–3, 2010
- José Natário, Gödel universe and the isoperimetric problem, III Workshop on Black Holes, Universidade do Minho, December 2010.
- José Natário, An elementary derivation of the Montgomery phase formula for the Euler top, Geometria em Lisboa, April 2010.
- José Natário, Formation of higher-dimensional topological black holes, PDEs, Relativity & Nonlinear Waves, Granada, April 2010.
- João P. Nunes, Examples of degenerating Kahler polarizations in geometric quantization, Mathematical Institute, University of Cologne, November 2010.
- Waldyr Muniz Oliva, An attempt on a definition of Morse Smale processes, ICMC Summer Meeting on Differential Equations, USP em São Carlos, Brazil, February 8–10, 2010.
- Rahul Pandharipande, Counting boxes, Colloquium, UC San Diego, January 2010.

- Rahul Pandharipande, Hilbert schemes of singular curves, Algebraic geometry seminar Caltech, January 2010.
- Rahul Pandharipande, Kappa rings of  $\mathcal{M}_g$ , Algebraic geometry seminar, Stanford Uni., March 2010.
- Rahul Pandharipande, Algebraic cobordism for varieties and bundles, Northeast algebraic geometry conference, UMass Amherst, April 2010.
- Rahul Pandharipande, Mnicourse: Counting invariants [2 lectures], VBAC 2010 conference, IST, Lisbon, June 2010.
- Rahul Pandharipande, Algebraic cobordism for varieties and bundles, Complex algebraic geometry conference, IHP, Paris, July 2010
- Rahul Pandharipande, DT invariants, future directions, Compositio prize conference, Amsterdam, July 2010.
- Rahul Pandharipande, Moduli of curves [3 lectures], Moduli conference, ANU Canberra, August 2010.
- Rahul Pandharipande, Rationality of counting functions for 3-folds, Conference on arithmetic and geometry, The Netherlands, September 2010.
- Rahul Pandharipande, Algebraic cobordism for varieties and bundles, Conference on motivic homotopy theory, HMI, Bonn, October 2010.
- Rahul Pandharipande, Relations in the tautological ring [2 lectures] , Moduli conference, Humboldt Univ, Berlin, October 2010.
- Rahul Pandharipande, Hodge integrals and the moduli of curves, ETH Zurich Colloquium, October 2010.
- Rahul Pandharipande, Relations in the tautological ring, Algebraic geometry seminar, Harvard Univ., November 23, 2010.
- Stavros Papadakis, Equivariant degenerations of spherical modules, Warwick Univ., England, November 3, 2010.
- Stavros Papadakis, Parallel unprojection of type Kustin–Miller, Vila Real, October 20, 2010.
- Stavros Papadakis, Parallel unprojection of type Kustin–Miller, Ioannina, Greece, May 27, 2010.
- Stavros Papadakis, Equivariant degenerations of spherical modules, Kaiserslautern, Germany, May 6, 2010.

- Stavros Papadakis, Saarbruecken, Germany, talk, date 20 April 2010  
title: Equivariant degenerations of spherical modules
- Stavros Papadakis, Parallel unprojection of type Kustin–Miller, Nicosia, Cyprus, March 24, 2010.
- Stavros Papadakis, The Enriques-Kodaira classification of complex projective surfaces, Mini-course at the Working Seminar on Contact/Syplectic Topology/Geometry, IST, Lisbon (3 sessions), February 9, 18 and March 2, 2010.
- Pedro Resende, Quantales of open groupoids, Workshop on Semigroups and Categories, Univ. Ottawa, Canada, May 2–4, 2010.
- Carlos Rocha, Sturm Global Attractors of Hamiltonian type for Semilinear Parabolic Equations, Workshop on Structures of Attractors in Dissipative Systems, Research Institute of Mathematical Sciences, Japan, November 15–17, 2010.
- Carlos Rocha, Sturm Global Attractors of Hamiltonian type, 3<sup>o</sup> Encontro IST-IME, Universidade de São Paulo, September 13–17, 2010.
- Carlos Rocha, Transversality in Semilinear Parabolic Equations under Periodic Boundary Conditions, ICMC Summer Meeting on Differential Equations, Universidade de São Paulo em São Carlos, February 08–10, 2010
- Pedro Martins Rodrigues, Beta-expansions and Arithmetic codings, Brigham Young University, Provo, USA, April 1, 2010.
- Pedro Martins Rodrigues, A Profinite Module associated to a hyperbolic toral automorphism, Algebra Seminar, IST, June 9, 2010.
- Ricardo Schiappa, The Resurgence of Instantons in String Theory, Invited Lecture Series, Taiwan String Theory Workshop, Taichung, December 15–18, 2010.
- Ricardo Schiappa, Borel and Stokes Analysis of Instantons in Topological Strings, III Iberian Mathematical Meeting, Braga, Portugal, October 2010.
- Ricardo Schiappa, Large-Order Behavior of Matrix Models and Topological Strings, Topological Strings, Modularity and Non-Perturbative Physics, Vienna, Austria, June 7–August 15, 2010.
- Jorge Drumond Silva, Local well-posedness for generalized KP-II type equations on cylinders, 2010 ICMC Summer Meeting on Differential Equations, USP-São Carlos, Brasil, February 9, 2010.

- Jorge Drumond Silva, Local well-posedness for generalized KP-II type equations on cylinders, Centro de Matemática da Universidade de Coimbra, March 19, 2010.
- Jorge Drumond Silva, Local well-posedness for generalized KP-II type equations on cylinders, Centro de Matemática e Aplicações, FCT - Universidade Nova de Lisboa, May 5, 2010.
- Jorge Drumond Silva, Local well-posedness for generalized KP-II type equations on cylinders, Centro de Matemática, Universidade do Minho, July 27, 2010.
- Anne-Laure Thiel, Categorification of singular braid monoids and of virtual braid groups, IST, Tqft club, October 2010.
- Anne-Laure Thiel, Catégorification des tresses singulières et des tresses virtuelles, Nantes, France, Topology, geometry and algebra seminar, October 2010.
- Joana Ventura, Reduced fusion systems and amalgam, Algebra and topology Seminar, Copenhagen University, Denmark, October 25, 2010.

## 6 Postdoctoral program and research fellows

The Center started a postdoctoral program in the academic year 1998/99. Positions are for one year, with the possibility of extension for a second year upon mutual agreement. Applicants must have earned a Ph.D. in mathematics preferably within a 2-year period before the opening date of the position. To be selected an applicant must show very strong research promise in one of the areas in which the members of the Center are currently active. There are no teaching duties associated with these positions. They are announced internationally including in the Notices and in the Data Base of the American Mathematical Society. In addition, the Center hosts postdoctoral fellows supported directly by the FCT or by other research projects, and, since 2007, research fellows on five year contracts funded by the CIÊNCIA program.

The following fellows have stayed in the Center during the whole or part of 2010:

- Inês Aniceto, PhD in Physics, Brown Univ., USA, 2009. Research areas: string theory. Supported by CAMGSD (Sep. 1, 2009–Aug. 31, 2010) and by FCT postdoctoral grant (Sep. 1, 2010–Aug. 31, 2013).
- Thomas Baier, PhD in Mathematics, IST, 2009. Research areas: Differential and symplectic geometry. Supported by CAMGSD (Jan. 10, 2010–May 10, 2010).



- Olivier Brahic, PhD in Mathematics, Univ. Montpellier II, France, 2004. Research areas: Poisson geometry, Lie groupoids and algebroids, representation theory. Supported by an FCT postdoctoral grant (Jan. 2006–Jan. 2012).
- Filippo Cagnetti, PhD in Applied Mathematics, SISSA, Trieste, Italy, 2007. Research Areas: Calculus of variations and partial differential equations. Supported by the CMU/Portugal Program (Sep. 1, 2009–Feb. 28, 2011) and by the UT Austin/Portugal Program (Mar. 1, 2011–Feb. 28, 2014).
- Michele Cirafici, PhD in Physics, SISSA Trieste, 2004. Research areas: string theory, quantum field theory, geometry. Supported by the CIÊNCIA 2008 Program (Sep. 1, 2009–Aug. 31, 2014).
- Radoslaw Czaja, PhD in Mathematics, Univ. Silesia, Katowice, Poland, 2004. Research areas: continuous dynamical systems, partial differential equations. Supported by the CIÊNCIA 2008 Program (Sep. 1, 2009–Aug. 31, 2014).
- Rachel Dawe Martins, PhD in Mathematical Physics, Nottingham Univ., 2006. Research areas: Noncommutative geometry, spectral triples, standard model of particle physics,  $K$ -theory. Supported by an FCT postdoctoral grant (Oct. 2006–Jul. 2014).
- Sebastian Guttenberg, PhD in Physics, Technical Univ. Vienna, Austria, 2007. Research areas: string theory. Supported by FCT postdoctoral grant (Sep. 1, 2010–Aug. 31, 2013).
- Sharon Hollander, PhD in Mathematics, MIT, 2001. Research areas: algebraic topology and algebraic geometry. Supported by CAMGSD (Nov. 1, 2006–Dec. 31, 2008), and by the CIÊNCIA 2007 Program (Jan. 1, 2008–Dec. 31, 2012).
- William Kirwin, PhD in Mathematics, University of Colorado, Boulder, USA, 2004. Research areas: Symplectic geometry, Lie groups and algebras, quantization. Supported by CAMGSD (Dec. 15, 2009, Jul. 15, 2011).
- Rémi Leclercq, PhD in Mathematics, University of Montréal, Canada, 2007. Research areas: symplectic topology, spectral invariants for Lagrangian Floer homology, Seidel morphism. Supported by CAMGSD (Sep. 1, 2010–Aug. 31, 2011).
- Éveline Legendre, PhD in Mathematics, University of Québec at Montreal, Canada, 2010. Research areas: Kähler geometry, toric manifolds. Supported by an NSERC (Canada) postdoctoral grant (Sept. 1, 2010 – Aug. 31, 2012).

- Michal Málek, PhD in Mathematics, Silesian Univ., Opava, Czech Republic, 2002. Research areas: discrete dynamical systems. Supported by CAMGSD (Sep. 1, 2008–Jun. 30, 2010).
- Alessia Mandini, PhD in Mathematics, Univ. Bologna, Italy, 2007. Research areas: symplectic geometry. Supported by the CAMGSD funding (Sep. 1, 2007–May 31, 2009), and by an FCT postdoctoral grant (Jun. 1, 2009–May 31, 2012).
- David Martinez Torres, PhD in Mathematics, Univ. Carlos III de Madrid, 2003. Research areas: symplectic, contact and Poisson geometry. Supported by the CIÊNCIA 2007 Program (Jul. 1, 2008–Jun. 30, 2013).
- Jeffrey Morton, PhD in Mathematics. University of California, Riverside, 2007. Research areas: mathematical physics, topology, category theory. Supported by CAMGSD postdoctoral grant (Sep. 1, 2010–Aug. 31, 2011).
- Nicolas Orantin, PhD in Mathematical Physics, CEA-Saclay, France, 2007. Research areas: string theory. Supported by FCT postdoctoral grant (Sep. 1, 2010–Aug. 31, 2013).
- Stavros Papadakis, PhD in Mathematics, Warwick Univ., UK, 2002. Research areas: birational geometry, commutative algebra, computer algebra methods in algebraic geometry, algebraic surfaces, unprojection. Supported by an FCT postdoctoral grant (Jul. 2006–Jun. 2012).
- Ioannis Parissis, PhD in Mathematics, Univ. Crete, Greece, 2007. Research area: Harmonic Analysis. Supported by the CAMGSD funding (Nov. 1, 2009–Oct. 31, 2011).
- Paulo Pires Pacheco, PhD in Physics, Imperial College, London, UK, 2007. Research areas: string theory. Supported by an FCT postdoctoral grant (Oct. 2008–Oct. 2010).
- Carlo Antonio Rossi, Dr. Sc. Math. Universität Zürich, Switzerland, 2002. Research areas: deformation quantization and applications thereof. Supported by the CIÊNCIA 2008 Program (Sep. 1, 2009–Aug. 31, 2010).
- Florian Schätz, PhD in Mathematics, Univ. Zürich, Switzerland, 2009. Research areas: Poisson geometry, homological and homotopical algebra, supergeometry, deformation/moduli problems. Supported by the CAMGSD funding (Sep. 1, 2009–Sep. 30, 2010) and by an FCT postdoctoral grant (Oct. 1, 2010–Oct. 1, 2013).

- Ricardo Schiappa, PhD in Physics, MIT, USA, 1999. Research areas: String theory and mathematical physics. Supported by the CIÊNCIA 2007 Program (Mar. 1, 2008–Feb. 28, 2013).
- Gabrielle Terrone, PhD in Mathematics, Univ. Padova, 2008. Research areas: Viscosity solutions of Hamilton–Jacobi equations. Supported by UTAustin-Portugal program (Sep. 1, 2008–Sep. 1, 2011).
- Anne-Laure Thiel, PhD in Mathematics, Univ. Strasbourg, France, 2010. Research areas: Categorification, braids, knots. Supported by a postdoctoral grant of the FCT-funded research project: New Geometry and Topology PTDC/MAT/101503/2008 (Sep. 1, 2010–Aug. 31, 2012).
- Claudia Valls, Doctor in Mathematics, Univ. Barcelona, Spain, 1999. Research areas: dynamical systems. Supported by two FCT postdoctoral grants (Oct. 2003–Jan. 2008) and by the CIÊNCIA 2007 Program (Feb. 1, 2008–May 16, 2010).
- Marcel Vonk, PhD in Physics, Univ. Amsterdam, The Netherlands, 2003. Research areas: string theory. Supported by CAMGSD (Sep. 1, 2008–Mar. 31, 2011).

## 7 Doctoral supervision

The following doctoral degrees have been obtained under supervision of members of the Center:

- Sandra Vaz, Universidade da Beira Interior, January 2010.  
Thesis title: Discrete Dynamical Systems and Number Theory.  
Supervised by Pedro Martins Rodrigues.
- Ana Rita Pires, MIT, May 2010.  
Thesis title: Symplectic Origami.  
Co-supervised by Ana Cannas da Silva.
- Benjamin Bakker, Princeton University, June 2010.  
Thesis title: Hodge polynomials of moduli spaces of stable pairs on K3 surfaces.  
Supervised by Rahul Pandharipande.

## 8 Publications in 2010

### 8.1 Publications which appeared in 2010

#### Books & Monographs

L. Barreira and C. Valls, Exercícios de Análise Complexa e Equações Diferenciais, Coleção Apoio ao Ensino, **f**, IST Press, 2010.

L. Barreira and C. Valls, Equações Diferenciais: Teoria Qualitativa, Coleção Ensino da Ciência e da Tecnologia, **33**, IST Press, 2010.

M. Crainic and R. Fernandes, Lectures on integrability of Lie brackets, Geometry & Topology Monographs, **17**, Mathematical Sciences Publishers, 2010.

### Articles in refereed international journals

M.C. Abbott, I. Aniceto, and D. Bombardelli, Quantum Strings and the  $AdS_4/CFT_3$  Interpolating Function, *J. High Energy Phys.*, (2010), no. 12, 040, 36pp.

M. Abreu, Toric Kähler metrics: cohomogeneity one examples of constant scalar curvature in action-angle coordinates, *J. Geom. Phys.*, **17** (2010) 1–33.

M. Abreu, Kähler-Sasaki geometry of toric symplectic cones in action-angle coordinates, *Port. Math.*, **67** (2010), no. 2, 121–153.

I. Aniceto, J. Avan and A. Jevicki, Poisson structures of Calogero-Moser and Ruijsenaars-Schneider models, *J. Phys. A*, **43** (2010), no. 18, 185201, 14pp.

M. Baia and P.M. Santos, A note on concentrations for integral two-scale problems, *Ricerche Mat.*, **59** (2010), no. 1, 1–22.

T. Baier, J.M. Mourão and J.P. Nunes, Quantization of abelian varieties: distributional sections and the transition from Kähler to real polarizations, *J. Funct. Anal.*, **258** (2010), 3388–3412.

J. Baptista, Non-abelian vortices, Hecke modifications and singular monopoles, *Lett. Math. Phys.*, **92** (2010), no. 3, 243–252.

L. Barreira, Almost additive thermodynamic formalism: some recent developments, *Rev. Math. Phys.*, **22** (2010) 1147–1179.

L. Barreira, J. Llibre and C. Valls, Periodic orbits near equilibria, *Comm. Pure Appl. Math.*, **63** (2010), no. 9, 1225–1236.

L. Barreira and C. Valls, Stable manifolds for impulsive equations under nonuniform hyperbolicity, *J. Dynam. Differential Equations*, **22** (2010), no. 4, 761–785.

L. Barreira and C. Valls, Polynomial contractions and Lyapunov regularity, *Nonlinear Anal.*, **73** (2010), 202–210.

L. Barreira and C. Valls, Dependence of topological conjugacies on parameters, *J. Dynam. Differential Equations*, **22** (2010), no. 4, 787–803.

- L. Barreira and C. Valls, Smooth stable invariant manifolds and arbitrary growth rates, *Nonlinear Anal.*, **72** (2010), 2444–2456.
- L. Barreira and C. Valls, Smooth robustness of parameterized perturbations of exponential dichotomies, *J. Differential Equations*, **249** (2010), no. 8, 2021–2043.
- L. Barreira and C. Valls, Quadratic Lyapunov sequences and arbitrary growth rates, *Discrete Contin. Dyn. Syst.*, **26** (2010), no. 1, 63–74.
- L. Barreira and C. Valls, Stability of delay equations via Lyapunov functions, *J. Math. Anal. Appl.*, **365** (2010), no. 2, 797–805.
- L. Barreira and C. Valls, Center manifolds for nonuniform trichotomies and arbitrary growth rates, *Commun. Pure Appl. Anal.*, **9** (2010), no. 3, 643–654.
- L. Barreira and C. Valls, Optimal regularity of robustness for parameterized perturbations, *Bull. Sci. Math.*, **134** (2010), no. 7, 767–785.
- L. Barreira and C. Valls, Lyapunov regularity of impulsive differential equations, *J. Difference Equ. Appl.*, **249** (2010), 1596–1619.
- L. Barreira and C. Valls, Lyapunov functions for trichotomies with growth rates, *J. Differential Equations*, **248** (2010), no. 1, 151–183.
- L. Barreira and C. Valls, Stability theory of general contractions for delay equations, *Integral Equations Operator Theory*, **68** (2010), no. 3, 413–426.
- L. Barreira and C. Valls, Nonuniform stability of difference equations with infinite delay, *Adv. Nonlinear Stud.*, **10** (2010), no. 1, 121–129.
- L. Barreira and C. Valls, Robustness for impulsive equations, *Nonlinear Anal.*, **72** (2010), no. 5, 2542–2563.
- L. Barreira and C. Valls, Lyapunov sequences for exponential trichotomies, *Nonlinear Anal.*, **72** (2010), no. 1, 192–203.
- L. Barreira and C. Valls, Parameter dependence of stable manifolds for difference equations, *Nonlinearity*, **23** (2010), no. 2, 341–367.
- L. Barreira and C. Valls, Admissibility for nonuniform exponential contractions, *J. Differential Equations*, **249** (2010), no. 11, 2889–2904.
- L. Barreira and C. Valls, Stability of dichotomies in difference equations with infinite delay, *Nonlinear Anal.*, **72** (2010), no. 2, 881–893.
- L. Barreira and C. Valls, Center manifolds for difference equations—smooth parameter dependence, *Nonlinear Anal.*, **73** (2010), no. 3, 725–749.
- L. Barreira, J. Llibre and C. Valls, On a degenerate Hopf bifurcation, *J. Phys. A*, **43** (2010), no. 28, 285201, 14pp.
- L. Barreira, M. Fan, C. Valls and J. Zhang, Invariant manifolds for impulsive equations and nonuniform polynomial dichotomies, *J. Stat. Phys.*, **141** (2010), no. 1, 179–200.

- A. Barroso and J.C. Matias, An ill posed problem in  $SBV_0^2(\Omega)$ , *J. Convex Anal.*, **17** (2010), no. 2, 357–380.
- O. Brahic, Extensions of Lie brackets, *J. Geom. Phys.*, **60** (2010), no. 2, 352–374.
- A. Cannas da Silva, Fold-forms for four-folds, *J. Symplectic Geom.*, **8** (2010), no. 2, 189–203.
- G.L. Cardoso, B. de Wit and S. Mahapatra, BPS black holes, the Hesse potential and the topological string, *J. High Energy Phys.* (2010), no. 6, 052, 29pp.
- G.L. Cardoso, G. Dall’Agata and V. Grass, On subextensive corrections to fluid dynamics from gravity, *J. High Energy Phys.* (2010), no. 4, 064, 27pp.
- R. Cordovil, M. Lemos, The 3-connected matroids with circumference 6, *Discrete Math.*, **310** (2010), no. 8, 1354–1365.
- J. Duarte, C. Januário, N. Martins and J. Sardanyés, Quantifying chaos for ecological stoichiometry, *Chaos*, **20** (2010) 033105, 9pp.
- R.L. Fernandes and M. Crainic, Stability of symplectic leaves, *Invent. Math.*, **180** (2010), no. 3, 481–533.
- J. M. Ferreira and S. Pinelas. Oscillatory Mixed Differential Systems, *Funkcial. Ekvac.*, **53** (2010) 1–20.
- J.M. Ferreira and S. Pinelas, Oscillatory nonautonomous Lucas Sequences, *Int. J. Differ. Equ.*, (2010), Art. ID 596350, 15 pp.
- B. Fiedler and C. Rocha, Connectivity and Design of Planar Global Attractors of Sturm Type. III: Small and Platonic Examples, *J. Dynam. Differential Equations*, **22** (2010) 121–162.
- P. Girão and H. Tehrani, On the Fucik spectrum of the wave operator and an asymptotically linear problem, *J. Math. Anal. Appl.*, 366 (2010), no. 1, 55–66.
- L. Godinho and M.E. Sousa-Dias, The fundamental group of  $S^1$ -manifolds, *Canad. J. Math.*, **62** (2010), no. 5, 1082–1098.
- D. Gomes, R. Iturriaga, H. Sánchez-Morgado and Y. Yu, Mather measures selected by an approximation scheme, *Proc. Amer. Math. Soc.*, **138** (2010), no. 10, 3591–3601.
- D. Gomes, J. Mohr and R. Souza, Discrete time, finite state space mean field games, *J. Math. Pures Appl.*, (9) **93** (2010), no. 3, 308–328.
- D.A. Gomes, N. Jung and A. Lopes, Minimax probabilities for Aubry-Mather problems, *Commun. Contemp. Math.*, **12** (2010), no. 5, 789–813.
- M. Gross and R. Pandharipande, Quivers, curves, and the tropical vertex, *Port. Math.*, **67** (2010), no. 2, 211–259.

- M. Gross, R. Pandharipande and B. Siebert, The tropical vertex, *Duke Math. J.*, **153** (2010), no. 2, 297–362.
- T. Harmark, J. Natário and R. Schiappa, Greybody Factors for d-Dimensional Black Holes, *Adv. Theor. Math. Phys.*, **14** (2010).
- W. D. Kirwin, Higher asymptotics of Laplace’s approximation, *Asymp. Anal.*, **70** (2010), no. 3-4, 231–248.
- W. Kirwin, A. Uribe, Theta functions on the Kodaira-Thurston manifold, *Trans. Amer. Math. Soc.*, **362** (2010), no. 2, 897–932.
- A. Klemm, D. Maulik, R. Pandharipande and E. Scheidegger, Noether-Lefschetz theory and the Yau-Zaslow conjecture, *J. Amer. Math. Soc.*, **23** (2010), no. 4, 1013–1040.
- C. Liedtke and S. Papadakis, Birational modifications of surfaces via unprojections, *J. Algebra*, **323** (2010), 2510–2519.
- J. Llibre and C. Valls, The Bianchi *VIII* model is neither global analytic nor Darboux integrable, *J. Math. Phys.*, **51** (2010), 092702, 13pp.
- J. Llibre and C. Valls, On the local analytic integrability at the singular point of a class of Liénard analytic differential systems, *Proc. Amer. Math. Soc.*, **138** (2010), 253–261.
- J. Llibre and C. Valls, On the limit cycles of polynomial differential systems with homogeneous nonlinearities of degree 3 via the averaging method, *Dyn. Contin. Discrete Impuls. Syst. Ser. A Math. Anal.*, **17** (2010), no. 4, 453–473.
- J. Llibre and C. Valls, Nonintegrability of a class of the Bianchi  $VI_0$  and  $VII_0$  models, *J. Geom. Phys.*, **60** (2010), no. 5, 815–822.
- J. Llibre and C. Valls, Analytical integrability of the Rikitake system, *Z. Angew. Math. Phys.*, **61** (2010), no. 4, 627–639.
- J. Llibre and C. Valls, The Michelson system is neither global analytic, nor Darboux integrable, *Phys. D*, **239** (2010), no. 8, 414–419.
- J. Llibre and C. Valls, Liouvillian integrability of the FitzHugh-Nagumo systems, *J. Geom. Phys.*, **60** (2010), no. 12, 1974–1983.
- J. Llibre and C. Valls, Centers and isochronous centers for two classes of generalized seventh and ninth systems, *J. Dynam. Differential Equations*, **22** (2010), 657–675.
- J. Llibre and C. Valls, On the integrability of a tritrophic food chain model, *Adv. Nonlinear Stud.*, **10** (2010), no. 2, 331–355.
- J. Llibre and C. Valls, Liouvillian first integrals for Liénard polynomial differential systems, *Proc. Amer. Math. Soc.*, **138** (2010), no. 9, 3229–3239.

- R. Luís, S. Elaydi and H. Oliveira, Non-autonomous periodic systems with Allee effects, *J. Difference Equ. Appl.* **16** (2010), no. 10, 1179–1196.
- M. A. Mackaay and P. Vaz, The diagrammatic Soergel category and  $sl(N)$ -foams for  $N \geq 4$ , *Internat. J. Math. Sci.*, (2010) Art. ID 468968, 20 pp.
- D. Martínez Torres, A note on the separability of canonical integrations of Lie algebroids, *Math. Res. Lett.*, **17** (2010), no. 1, 69–75.
- J.F. Martins and R. Picken, On two-dimensional holonomy, *Trans. Amer. Math. Soc.*, **362** (2010), no. 11, 5657–5695.
- D. Matsnev and P. Resende, Étale groupoids as germ groupoids and their base extensions, *Proc. Edinb. Math. Soc.*(2) **53** (2010), no. 3, 765–785
- D. Maulik, R. Pandharipande, and R. P. Thomas. Curves on  $K3$  surfaces and modular forms, *J. Topology*, **3** (2010) no. 4, 937–996.
- F. Mena, J. Natário and P. Tod, Formation of Higher-dimensional Topological Black Holes, *Ann. Henri Poincaré*, **10** (2010), no. 7, 1359–1376.
- M. Mendes Lopes and R. Pardini, On surfaces with  $p_g = 2q - 3$ , *Adv. Geom.*, **10** (2010), no. 3, 549–555 .
- J. Natário, An elementary derivation of the Montgomery phase formula for the Euler top, *J. Geom. Mech.*, **2** (2010), no. 1, 113–118.
- A. Okounkov and R. Pandharipande, The local Donaldson-Thomas theory of curves, *Geom. Topol.*, **14** (2010), no. 3, 1503–1567.
- A. Okounkov and R. Pandharipande, Quantum cohomology of the Hilbert scheme of points in the plane, *Invent. Math.*, **179** (2010), no. 3, 523–557.
- W.M. Oliva and C. Rocha, Reducible Volterra and Levin-Nohel retarded equations with infinite delay, *J. Dynam. Differential Equations*, **22** (2010), no. 3, 509–532.
- W.M. Oliva and G. Terra, Birkhoffian systems in infinite dimensional manifolds, *J. Dynam. Differential Equations*, **22** (2010), no. 2, 193–201.
- W.M. Oliva and G. Terra, An inverse problem on vakonomic mechanics, *Bol. Soc. Esp. Mat. Apl. SĒMA*, N<sup>o</sup> **51** (2010), 141–148.
- R. Pandharipande and R. Thomas, Stable pairs and BPS invariants, *J. Amer. Math. Soc.*, **23** (2010), no. 1, 267–297.
- S. Pasquetti, R. Schiappa, Borel and Stokes nonperturbative phenomena in topological string theory and  $c = 1$  matrix models, *Ann. Henri Poincaré*, **11** (2010), no. 3, 351–431.
- P. Resende and E. Rodrigues, Sheaves as Modules, *Appl. Categ. Structures*, **18** (2010), no. 2, 199–217.



- C. Rito, Involutions on surfaces with  $p_g = q = 1$ , *Collect. Math.*, **61** (2010), no. 1, 81–106.
- C. Rito, On equations of double planes with  $p_g = q = 1$ , *Math. Comp.*, **79** (2010), no. 270, 1091–1108.
- S. Sandon, An integer valued bi-invariant metric on the group of contactomorphisms of  $R^{2n} \times S^1$ , *Journal of Topology and Analysis* **2** (2010), no. 3, 327–339.
- R. M. Saramago, Dieudonné module structures for ungraded and periodically graded Hopf rings, *Algebr. Represent. Theory*, **13** (2010), no. 5, 521–541.
- F. Schaetz, Invariance of the BFV complex, *Pacific J. Math.*, **248** (2010) no. 2, 453–474.
- R. Schiappa, N. Wyllard, An  $A_r$  threesome: matrix models,  $2d$ -conformal field theories, and  $4d, N = 2$  gauge theories, *J. Math. Phys.*, **51** (2010), no. 8, 082304, 35 pp.
- C. Valls, Centre manifold variety for eight-parameter families of polynomial vector fields of arbitrary degree, *Proc. Edinb. Math. Soc. (2)*, **53** (2010), no. 2, 511–530.
- C. Valls, On the anisotropic potentials of Manev-Schwarzschild type, *Internat. J. Bifur. Chaos Appl. Sci. Engrg.*, **20** (2010), no. 4, 1233–1243.

### Communications in refereed proceedings

- M.J. Borges and F. Fabião, Existence of periodic solutions for a modified growth solow model. *AIP Conf. Proc.*, **1293** (2010) 97–106.
- R. Pandharipande and A. Zinger, Enumerative geometry of Calabi-Yau 5–folds. New developments in algebraic geometry, integrable systems and mirror symmetry, *Adv. Stud. Pure Math.*, **59** (2010) 239–288.

## 8.2 Accepted publications (submitted or accepted in 2010)

### Books

- L. Barreira and C. Valls, Exercícios de Álgebra Linear, Coleção Apoio ao Ensino, **g**, IST Press, to appear.
- L. Barreira, Analyse Complexe et Équations Différentielles, EDP Sciences, to appear.
- L. Barreira and C. Valls, Exercices d’Analyse Complexe et Équations Différentielles, EDP Sciences, to appear.

### Articles in refereed international journals

- J. Baptista, On the  $L^2$ -metric of vortex moduli spaces, *Nucl. Phys. B*, to appear.
- L. Barreira and C. Valls, Center manifolds - optimal regularity for nonuniformly hyperbolic dynamics, *São Paulo J. Math. Sci.*, to appear.
- L. Barreira and C. Valls, Robust nonuniform dichotomies and parameter dependence, *J. Math. Anal. Appl.*, to appear.
- L. Barreira and C. Valls, Center manifolds for impulsive equations under nonuniform hyperbolicity, *Nonlinear Anal.*, to appear.
- L. Barreira and C. Valls, Regularity of center manifolds under nonuniform hyperbolicity, *Discrete Contin. Dyn. Syst.*, to appear.
- L. Barreira and C. Valls, Smooth robustness of exponential dichotomies, *Proc. Amer. Math. Soc.*, to appear.
- L. Barreira and C. Valls, Nonuniform exponential dichotomies and admissibility, *Discrete Contin. Dyn. Syst.*, to appear.
- L. Barreira and G. Iommi, Multifractal analysis and phase transitions for hyperbolic and parabolic horseshoes, *Israel J. Math.*, to appear.
- O. Brahic and C. Zhu, Lie algebroid fibrations, *Adv. Math.*, to appear.
- F. Cagnetti,  $k$ -quasiconvexity reduces to quasiconvexity, *Proc. Roy. Soc. Edinburgh Sect. A.*, to appear.
- A. Cannas da Silva, V. Guillemin, A. R. Pires, Symplectic origami, *Int. Math. Res. Not.*, to appear.
- A. C. Casimiro and C. Rodrigo, First variation formula for discrete variational problems in two independent variables, *Rev. R. Acad. Cienc. Exactas Fis. Nat. Ser. A Mat.*, to appear.
- C. Correia Ramos, N. Martins and P. Pinto, Interval maps from Cuntz-Krieger algebras, *J. Math. Anal. Appl.*, to appear.
- M. Crainic, R. L. Fernandes, A geometric approach to Conn's linearization theorem, *Annals of Math.*, to appear.
- R. Czaja and M. Efendiev, Pullback exponential attractors for nonautonomous equations Part I: Semilinear parabolic problems, *J. Math. Anal. Appl.*, to appear.
- R. Czaja and M. Efendiev, Pullback exponential attractors for nonautonomous equations Part II: Applications to reaction-diffusion systems, *J. Math. Anal. Appl.*, to appear.
- R. L. Fernandes and P. Frejlich, A  $h$ -principle for symplectic foliations, *Int. Math. Res. Not.*, to appear.

- P. M. Girão, Bifurcation curves of a logistic equation when the linear growth rate crosses a second eigenvalue, *Nonlinear Anal.*, to appear.
- C. Gordon, W. D. Kirwin, D. Scheuth and D. Webb, Quantum Equivalent Magnetic Fields that Are Not Classically Equivalent, *Ann. de l'Inst. Four.*, to appear.
- S. Hollander, Characterizing Artin Stacks, *Math. Z.*, to appear.
- W. D. Kirwin and B. C. Hall, Adapted complex structures and the geodesic flow, *Math. Ann.*, to appear.
- W. D. Kirwin, Higher Asymptotics of Unitarity in Quantization Commutes with Reduction, *Math. Z.*, to appear.
- J. Llibre and C. Valls, Analytic integrability of quadratic-linear polynomial differential systems, *Ergodic Theory Dynam. Systems*, to appear.
- M. Marti Sanchez, Even sets of  $(-4)$ -curves on rational surfaces, *Osaka J. Math.*, to appear.
- M. Marti Sanchez, Surfaces with  $K^2 = 2\mathcal{X} - 2$  and  $p_g \geq 5$ , *Geom. Dedicata*, to appear.
- D. Martínez Torres, Generic linear systems for projective CR manifolds, *Differential Geometry and its Applications*, to appear.
- D. Martínez Torres, A note on strict  $C$ -convexity, *Rev. Mat. Complut.*, to appear.
- D. Martínez Torres, Universal models via embedding and reduction for locally conformal symplectic structures, *Ann. Global Anal. Geom.*, to appear.
- J.F. Martins and R. Picken, The fundamental Gray 3-groupoid of a smooth manifold and local 3-dimensional holonomy based on a 2-crossed module, *Diff. Geometry and its Applications*, to appear.
- J.F. Martins and R. Picken, Surface holonomy for non-abelian 2-bundles via double groupoids, *Adv. Math.*, to appear.
- M. Mendes Lopes, R. Pardini and G.P. Pirola, A characterization of the symmetric square of a curve, *Int. Math. Res. Not.*, to appear.
- M. Mendes Lopes, R. Pardini and G.P. Pirola, On the canonical map of surfaces with  $q \geq 6$ , *Science in China*, to appear.
- J. Nelson and R. Picken, Quantum geometry from 2+1 AdS quantum gravity on the torus, *Gen. Relativity Gravitation*, to appear.
- R. Pandharipande, Descendent bounds for effective divisors on the moduli space of curves, *J. Alg. Geom.*, to appear.
- C. Rocha and B. Fiedler, Sturm global attractors of Hamiltonian type for semilinear parabolic equations, To appear in *RIMS Kôkyûroku*.

S. Sandon, Equivariant Homology of Generating Functions and Orderability of Lens Spaces, *J. Symplectic Geom.*, to appear.

R. M. Saramago, Induced Hopf Coring Structures, *J. Korean Math. Soc.*, to appear.

A. Thiel, Virtual braid groups of type B and weak categorification, *J. Knot Theory Ramifications*, to appear.

A. Thiel, Categorification of the virtual braid groups, *Ann. Math. Blaise Pascal*, to appear.

### **Paper in refereed proceedings of International Conference**

M. M. Lopes and R. Pardini, The geography of irregular surfaces, Proceedings of the workshop *Classical Algebraic Geometry Today*, MSRI, January 2009, to appear.

### **8.3 Preprints submitted in 2010 (not yet accepted)**

M. Abreu and L. Macarini, Contact homology of good toric contact manifolds, preprint 2010.

M. Baía, P. M. Santos and J.C. Matias, A relaxation result in the framework of structured deformations, preprint 2010.

M. Barchiesi, F. Cagnetti, N. Fusco, Stability of the Steiner symmetrization of convex sets. preprint 2010.

F. Cagnetti, D. Gomes, H. V. Tran, Aubry-Mather measures in the non convex setting, preprint, 2010.

M. Cirafici, A. Sinkovics and Richard J. Szabo, Instantons, Quivers and Noncommutative Donaldson-Thomas Theory, preprint 2010.

W. D. Kirwin, Isotropic foliations of coadjoint orbits from the Iwasawa decomposition, preprint 2010.

W. Kirwin, J. Mourão, J.P. Nunes, Degeneration of Kähler Structures and Half-Form Quantization of Toric Varieties, preprint 2010.

F. Oliveira, M. Panthee and J. Drumond Silva, On the Cauchy problem for the elliptic Zakharov-Schulman system in dimensions 2 and 3, preprint 2010.

Y.-P. Lee and R. Pandharipande, Algebraic cobordism of bundles on varieties, preprint 2010.

P. Lopes and J.P. Matias, Exact results on minimum number of colors via small prime divisors, preprint 2010.

P. Lopes and J.P. Matias, Minimum number of colors: the Turk's head knots case study, Preprint 2010.

M. Mendes Lopes, R. Pardini and G.P. Pirola, On surfaces of general type with  $q = 5$ , preprint 2010.

J. Morton, Extended TQFT, Gauge Theory, and 2 – –Linearization, Preprint 2010.

A. Pixton and R. Pandharipande, Descendent theory for stable pairs, preprint 2010.

A. Pixton and R. Pandharipande, Descendents on local curves: rationality, preprint 2010.

A. Pixton and R. Pandharipande, Berlin lectures on the moduli space of curves, preprint 2010.

## 9 Partnership and outreach

In October 2004 the Center submitted to the Minister of Science, Innovation and Higher Education a request for the Statute of Associate Laboratory, with a strategic project entitled “Internationalization of the Research and Promotion of Mathematics in Portugal”. Besides pursuing the strategy of further development and internationalization of the research activities, in particular through the Postdoctoral Program and a Program for career development and employment of new researchers, the Center signed partnership protocols with the Institute for Systems and Robotics - Lisbon (Instituto de Sistemas e Robótica-Lisbon) and with the Institute of Telecommunications (IT) regarding interdisciplinary research cooperation, and also signed partnership protocols with 44 secondary and primary schools, which together enroll more than 38000 students, aiming at the promotion of Mathematics at these education levels through a set of activities oriented towards students and teachers.

While the evaluation of the request for the Statute of Associate Laboratory is still in progress, the Center has nevertheless started to develop various activities in collaboration with the secondary schools and it has also pursued its past collaboration with the “Ciência Viva” Program and with the “Programa Gulbenkian Novos Talentos em Matemática”. Some of these activities are listed below.

### **O Gosto pela Matemática – Uma Década de Talentos**

*Fundação Calouste Gulbenkian, Lisboa, July, 15–17, 2010*

*Invited Speakers:*

- Lenny Ng, Duke University
- Rahul Pandharipande, Princeton University
- Bjorn Poonen, MIT

- Stanislav Smirnov, Université de Genève

<http://www.math.ist.utl.pt/talentos/festa2010/>

**Winter school for undergraduates.**

*Escola de Inverno de Matemática (EIM10)*, IST, February 1–9, 2010.

<http://www.math.ist.utl.pt/~mbaia/EIM10>

**Summer Course on the Geometry of Relativity**

*A Geometria da Relatividade*, IST, July 12–16 2010.

Estágio de iniciação científica para alunos do 11<sup>o</sup> ano.

<http://www.math.ist.utl.pt/~sanjos/estagio/>

**O Dia do Tempo**

José Natário and João P. Nunes participated in the one-day public event, *O Dia do Tempo*, Teatro Maria Matos, March 2010.

<http://www.teatromariamatos.pt/pt/prog/conversas/2009-2010/dia-do-tempo>

## 10 Personal notes

- Miguel Abreu was Chairman of the Scientific Committee of the III Iberian Mathematical Meeting, Universidade do Minho, Braga, Portugal, October 1–3, 2010.
- Miguel Abreu is President of the Portuguese Mathematical Society (Sociedade Portuguesa de Matemática).
- Ana Cannas da Silva is Member of the Scientific Committee of the Program Novos Talentos em Matemática
- Ana Cannas da Silva was Guest editor of *Port. Math.*, **67** (2010) special issue dedicated to the Geometry Summer School (Lisbon 2009).
- Rui Loja Fernandes and Roger Picken were members of the Scientific Committee of the XIX International Fall Workshop on Geometry and Physics, Oporto, Portugal, September 6–9, 2010.
- Rui Loja Fernandes was chair of the Scientific Committee of the conference Poisson 2010 - Poisson geometry in Mathematics and Physics, IMPA, Rio de Janeiro, Brazil, July 20–30, 2010.
- Rui Loja Fernandes was elected to the Executive Committee of the European Mathematical Society.

- Carlos Florentino is a member of the Scientific Committee of the annual conference of the VBAC (Vector Bundles on Algebraic Curves) research group.
- Diogo Gomes is a member of the Scientific Council for Exact Sciences and Engineering of the FCT.
- Pedro Lopes was a member of the Scientific Committee for the XVII Encontro Brasileiro de Topologia held at Pontifícia Universidade Católica, Rio de Janeiro, Brazil, August 2–6, 2010.
- Pedro Lopes is spending his Sabbatical leave (2010/2011) at the University of Nottingham, UK with partial support from FCT through a Sabbatical grant (SFRH/BSAB/932/2009).
- Waldyr Oliva and Carlos Rocha were members of the Scientific Committee of the 2010 Chapter of the ICMC Meeting on Differential Equations, São Carlos, Brazil, February 8–10, 2010.
- Waldyr Muniz Oliva had a meeting in his honour, celebrating his 80th birthday: The 3rd Meeting IST-IME in São Paulo, Brasil, September 13–18, 2010.
- João P. Nunes was a member of the Scientific Committee for the National Meeting of the SPM 2010.
- Carlos Rocha was member of the Scientific Committee of the 3<sup>o</sup> Encontro IST-IME celebrating the 80th birthday of Waldyr Muniz Oliva, Universidade de São Paulo, Setembro 13–17, 2010.