



Instituto Superior Técnico



Center for Mathematical Analysis,
Geometry, and Dynamical Systems

Report 2013

March 2014

Contents

1	Research Projects and Special Grants	3
2	Visitors	10
3	Seminar Series & Working Seminars	13
3.1	Algebra Seminar	13
3.2	Analysis, Geometry, and Dynamical Systems Seminar	13
3.3	Colloquium	13
3.4	Geometria em Lisboa Seminar	14
3.5	LARSyS Lecture Series in Engineering and Mathematics	15
3.6	Operator Theory, Complex Analysis and Applications Seminar	15
3.7	Partial Differential Equations Seminar	16
3.8	String Theory Seminar	16
3.9	Topological Quantum Field Theory Club	18
3.10	Working Seminar on Contact/Symplectic Topology/Geometry	18
4	Conferences and short courses	20
5	Seminars and lectures by Center members	23
6	Postdoctoral program and research fellows	31
7	Doctoral supervision	35
8	Publications in 2013	36
8.1	Publications which appeared in 2013	36
8.2	Accepted publications (submitted or accepted in 2013)	45
8.3	Preprints submitted (not yet accepted) in 2013	49
9	Partnership and outreach	52
10	Personal notes	54

1 Research Projects and Special Grants

The following research projects were coordinated by members of the Center in 2013:

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

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.

Brazilian-European Partnership in dynamical systems

(Started 01/01/2013, duration 4 years)

Funding agency: EU - Marie Curie Action IRSES

Reference: PIRSES-GA-2012-318999

Coordinator: Jeroen S. W. Lamb (Imperial College)

Coordinator at IST: Miguel Abreu

Number of Participants: 21 european partners and 11 brazilian partners

CMU | Portugal: ICTI Program in Applied Mathematics

Funding agency: Fundação para a Ciência e a Tecnologia

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

CoLab Program UT Austin | Portugal

Funding agency: Fundação para a Ciência e a Tecnologia

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

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

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.

Degenerate elliptic and parabolic equations and its applications to front propagation

Started 10/8/2011, duration 36 months

Funding agency: Fundação para a Ciência e a Tecnologia

Reference: UTA_CMU/MAT/0007/2009

Principal investigator: Diogo Gomes

Number of participants: 16

The main goals of the project are the study of pde's arising in front propagation, namely degenerate elliptic and parabolic equations, their application to concrete problems such as ocean fronts, and the development of numerical tools for the analysis of inverse problems in front propagation. We foresee that the developed techniques will be of interest for other problems also, such as mathematical finance, non-linear filtering, classical mechanics (Aubry-Mather theory and its extensions), mathematical biology, mean field games, homogenization and stochastic pde's.

Geometry and Mathematical Physics Project

(Started 01/05/2013, duration 3 years)

Funding agency: Fundação para a Ciência e a Tecnologia

Reference: EXCL/MAT-GEO/0222/2012

Principal investigator: Miguel Abreu

Number of participants: 30

This project aims at fostering the interaction of research in Geometry and Mathematical Physics within the Department of Mathematics of IST and throughout the country, through the stimuli for interaction among researchers, the reinforcement of international connections, the attraction of post-docs and doctoral students, and the organization of seminars, short courses and international meetings.

Geometry of quantization

(Started 1/1/2012, duration 36 months)

Funding agency: Fundação para a Ciência e a Tecnologia

Reference: PTDC/MAT/119689/2010

Principal investigator: José Mourão

Number of participants: 11

Study of the dependence of quantization on the choice of polarization, in the new formalism provided by the distributional approach to the prequantum bundle over families of complex structures. In this formalism, it is possible to include real and mixed nonnegative polarizations as points in the boundary of the space of complex structures.

Hamiltonian Actions and Integrability in Geometry and Topology

(Started 03/2012, duration 36 months)

Funding agency: Fundação para a Ciência e a Tecnologia

Reference: PTDC/MAT/117762/2010

Principal investigator: Miguel Abreu

Number of participants: 17

Devoted to certain global aspects of symplectic, contact and Poisson geometries, where Hamiltonian actions and integrability questions are relevant. These aspects include: Kaehler metrics invariant under Hamiltonian group actions; topology of certain Hamiltonian diffeomorphism groups; non-commutative integrable systems; polygon spaces and moduli spaces of bordered Riemann surfaces; Lagrangian intersection problems; Hamiltonian diffeomorphism groups of Poisson manifolds; complex hypersurfaces.

Higgs bundles and character varieties

(Started 3/2012, duration 36 months)

Funding agency: Fundação para a Ciência e a Tecnologia

Reference: PTDC/MAT/120411/2010

Principal investigator: Carlos Florentino

Number of participants: 6

This project deals with the geometry and topology of two classes of intimately related spaces: on one side, we have the moduli spaces of Higgs bundles or other holomorphic objects over a complex manifold, and on the other side we have character varieties, which are moduli spaces of representations of a finitely generated group into a Lie group.

In this project, we plan to address some of the facets of this profitable connection that are still undeveloped. Our approach will be a natural continuation of many important established results that were obtained in recent years by many mathematicians, including results from members of the project.

Non-linear degenerate elliptic equations and systems

(Started 1/1/2011, duration 36 months)

Funding agency: Fundação para a Ciência e a Tecnologia

Reference: PTDC/MAT/114397/2009

Principal investigator: Diogo Gomes

Number of participants: 14

This project focus on equations and systems of non-linear possibly degenerate elliptic partial differential equations, as well as its applications to stochastic optimal control, mean field games and Aubry-Mather theory.

Portuguese Algebraic Geometry Community

(Started 25/1/2013, duration 24 months)

Funding agency: Fundação para a Ciência e a Tecnologia

Reference: PTDC/MAT-GEO/0675/2012

Principal investigator: Margarida Mendes Lopes

Number of participants: 15

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.

Representations of Operator Algebras and Applications

(Started 25/5/2013, duration 24 months)

Funding agency: Fundação para a Ciência e a Tecnologia & CNRST-Morocco

Reference: P^o 441.00 CNRST - MOROCCO

Principal investigator: Paulo Pinto

Number of participants: 7

This project aims to promote the bilateral cooperation between researchers in Portugal and Morocco and is focused on problems linked to operator algebras and their relations with dynamical systems and mathematical physics.

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

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.

Stability of nonautonomous dynamical systems

(Started 03/2012, duration 36 months)

Funding agency: Fundação para a Ciência e a Tecnologia

Reference: PTDC/MAT/117106/2010

Principal investigator: Claudia Valls

Number of participants: 3

The main objective of the project is to pursue several directions of research in dynamical systems and differential equations, with emphasis on the study of stability of nonautonomous dynamics, particularly in the presence of nonuniform hyperbolicity, and on the qualitative study of polynomial vector fields and equations of mathematical physics, including their integrability.

Toeplitz Operators and Riemann-Hilbert problems: at the crossroad of operator theory and complex analysis

(Started 1/2/2012, duration 36 months)

Funding agency: Fundação para a Ciência e a Tecnologia

Reference: PTDC/MAT/121837/2010

Principal investigator: Maria Cristina Câmara

Number of participants: 3

The central object of this project is the interplay between Toeplitz operators and Riemann-Hilbert problems. It aims to study various properties of Toeplitz operators and to develop new methods to solve Riemann-Hilbert problems that arise in many areas in mathematics, as well as in connection with a variety of problems in Physics and Engineering, showing that progress in one topic goes hand in hand with progress in the other.

2 Visitors

The following researchers visited the Center in 2013:

Luke Wolcott, University of Western Ontario, January 8.

Petr Siegl, Universidade de Lisboa, January 17.

Pedro Patrício, Universidade do Minho, February 18.

Jacopo Stoppa, Università di Pavia, February 19.

Elisa Tenni, SISSA - Trieste, February 21.

Carlo Mariconda, Università degli Studi di Padova, February 25.

Bob Oliver, Université Paris XIII, March 7.

Christopher Edwards, Queen's College Oxford, March 13-20.

Aleksandar Mikovic, Universidade Lusófona, March 20.

Leonardo Macarini, Universidade Federal do Rio de Janeiro, March 26.

Jorge Ferreira, Universidade Federal Rural de Pernambuco, April 2.

Dimitrios Zoakos, Centro de Física do Porto, April 8.

Florin Radulescu, Università di Roma - Tor Vergata, April 14-20.

Ana Ribeiro, Universidade Nova de Lisboa, April 17.

Jorge Russo, Universitat de Barcelona, April 29.

Ivo Sachs, Ludwig-Maximilians-Universität München, May 6-8.

Filippo Cagnetti, University of Sussex, May 11-15.

Yasuyoshi Yonezawa, Nagoya University, May 11-17.

Alessio Figalli, University of Texas at Austin, May 14.

Matias del Hoyo, Utrecht University, May 16.

Sérgio Mendes, ISCTE-IUL, May 16.

Diego Bombardelli, Universidade do Porto, May 20.

Daniel Tubbenhauer, Georg-August-Universität Göttingen, June 1-16.

Stefano Giusto, Università di Padova, June 2-4.

Christian Le Merdy, Univ. Franche-Comté, CNRS, Besançon, June 3-8.

Dennis The, Australian National University, June 7.

Veselin Filev, Dublin Institute for Advanced Studies

Richard Szabo, Heriot-Watt University Edinburgh, June 11-13.

David Iglesias Ponte, Universidad de La Laguna, June 15-21.

Hans Ringström, KTH - Royal Institute of Technology, June 16-21.

Nelson Faustino, Universidade de Coimbra, June 20.
Song Sun, Imperial College, June 22-27.
Emanuele Dolera (Università di Modena e Reggio Emilia), June 27-28.
Leonard Monsaingeon, Carnegie Mellon University, June 27-July 3.
Oscar Varela, University of Utrecht, June 28.
Nick Sheridan, IAS and Princeton University, July 1.
Juan Carlos Naranjo Universitat de Barcelona, June 30-July 7.
Gian Pietro Pirola, Università di Pavia, June 17-July 16.
Ricardo Couso Santamaria, Univ. Santiago de Compostela, July 4-24.
David Martínez Torres, Utrecht University, July 8.
Carl Cowen, Indiana University-Purdue University Indianapolis, July 10-21.
Madalena Lemos, Stony Brook University, July 11.
Ricardo Vaz, Stony Brook University, July 11.
Thomas Baier, Universidade do Porto, July 15-19.
Eric Sommers, University of Massachusetts, July 16.
Marta Batoreo, University of California at Santa Cruz, July 17.
Peter Trapa, University of Utah, July 17.
Anthony Blanc, Université de Montpellier 2, July 17.
David Krejcirik, Nuclear Physics Inst. ASCR, Czech Republic, July 17-20.
Pavel Etingov, Massachusetts Institute of Technology, July 18.
Vladimir Voevodsky, Institute for Advanced Study, July 22-25.
Ana Rita Pires, Cornell University, July 23.
Agnès Gadbled, Universidade do Porto, July 29.
Travis Willse, The Australian National University, August 29.
Thomas Baier, Universidade do Porto, September 16-20.
Bernold Fiedler, Freie Universität Berlin, September 17-October 15.
Daniel Tubbenhauer, Georg-August-Universität Göttingen, Sep. 23-Oct. 1.
Nuno Freitas, Universität Bayreuth, September 30.
Boris Pioline, CERN Geneva, October 21.
Gonçalo Oliveira, Imperial College, October 29.
Tiago Fonseca, Université de Savoie, October 31-November 2.
Jaume Llibre, Universitat Autònoma de Barcelona, November 4-10.
Sergey Naboko, Kent University, November 6.

Abdelhamid Boussejra, Université Ibn Tofail, Kenitra, Morocco, Nov. 14.
Paul Richmond, University of Oxford, November 25-26.
David Berman, Queen Mary College London, December 2-3.
Thomas Baier, Universidade do Porto, December 2-6.
Antti Perälä, University of Helsinki, December 2-7.
Nuno Costa Dias, Universidade Lusófona, December 4.
Tiago Fonseca, Université de Savoie, December 8-21.
Kiril Hristov, Università degli Studi di Milano-Bicocca, December 9.
Carlos Guedes, Albert Einstein Institute, Potsdam-Golm, December 11.
Marko Vojinovic, Universidade de Lisboa, December 18.
Nuno Romão, Georg-August-Universität Göttingen, December 19-20.

3 Seminar Series & Working Seminars

3.1 Algebra Seminar

The following talks were given in 2013:

- **Luke Wolcott**, University of Western Ontario. *Bousfield lattices, quotients, ring maps, and non-Noetherian rings* (January 8).
- **Bob Oliver**, Université Paris XIII. *Local equivalences between finite Lie groups* (March 7).
- **Peter Trapa**, University of Utah. *Unitary representations of reductive Lie groups* (July 17).
- **Anthony Blanc**, Université de Montpellier 2. *Topological K-theory of complex non-commutative Spaces* (July 17).

3.2 Analysis, Geometry, and Dynamical Systems Seminar

This is the main seminar of the Center. The following talks were given in 2013:

- **Jorge Ferreira**, Universidade Federal Rural de Pernambuco. *On the asymptotic behaviour of nonlocal nonlinear problems* (April 2).
- **Florin Radulescu**, Università di Roma - Tor Vergata. *Ramanujan-Petersson conjectures and Operator Algebras* (April 16).
- **Filippo Cagnetti**, University of Sussex. *A new method for large time behavior of convex Hamilton-Jacobi equations* (May 14).
- **Christian Le Merdy**, Université de Franche-Comté. *Dilation of operators on L^p -spaces* (June 4).

3.3 Colloquium

The following lectures were given in 2013:

- **Alessio Figalli**, University of Texas at Austin. *Stability results for sumsets in \mathbb{R}^n* (May 14).
- **Vladimir Voevodsky**, Institute for Advanced Study. *Univalent Foundations of Mathematics* (July 23).

3.4 Geometria em Lisboa Seminar

The following talks were given in 2013:

- **Jacopo Stoppa**, Università di Pavia. *Refined curve counting, quivers, and wall-crossing* (February 19).
- **Elisa Tenni**, SISSA - Trieste. *Clifford theorem for singular curves and some applications* (February 21).
- **Milena Pabiniak**, Instituto Superior Técnico. *Lower bounds on Gromov width of coadjoint orbits through the Gelfand-Tsetlin pattern.* (March 12).
- **Leonardo Macarini**, Universidade Federal do Rio de Janeiro. *Two periodic orbits on the standard three-sphere* (March 26).
- **Matias del Hoyo**, Utrecht University. *On the linearization of certain smooth structures* (May 16).
- **Carlos Florentino**, Instituto Superior Técnico. *Irreducibility of character varieties of abelian groups* (May 21).
- **Dennis The**, Australian National University. *The gap phenomenon in parabolic geometries* (June 7).
- **Manuel Araújo**, Instituto Superior Tecnico. *Symplectic embeddings into $\mathbb{C}P^\infty$* (June 20).
- **Nick Sheridan**, Institute for Advanced Study and Princeton University. *Homological mirror symmetry* (July 1).
- **J. C. Naranjo and G. P. Pirola**, Universitat de Barcelona and Università di Pavia. *Isogenies between Jacobians* (July 3).
- **David Martínez Torres**, Utrecht University. *Non-contractible loops in the diffeomorphism group of coadjoint orbits* (July 8).
- **Eric Sommers**, University of Massachusetts. *Properties of some resolutions of Schubert varieties* (July 16).
- **Marta Batoreo**, University of California at Santa Cruz. *On hyperbolic points and periodic orbits of symplectomorphisms* (July 17).
- **Pavel Etingov**, Massachusetts Institute of Technology. *D-modules on Poisson varieties and Poisson traces.* (July 18).
- **Ana Rita Pires**, Cornell University. *The topology of topological toric origami manifolds* (July 23).

- **Gonçalo Oliveira**, Imperial College. *Monopoles in Higher Dimensions* (October 29).
- **Tiago Fonseca**, Laboratoire d'Annecy-le-Vieux de Physique Théorique, Université de Savoie. *The D-Kadomtsev–Petviashvili and its Grassmannian description* (October 31).
- **Alfonso Zamora**, Instituto Superior Técnico. *GIT characterizations of Harder-Narasimhan filtrations* (November 19).
- **João Pimentel Nunes**, Instituto Superior Técnico. *Complexified Hamiltonian flows and geodesics on the space of Kahler metrics* (December 10).
- **Nuno Romão**, University of Göttingen. *Supersymmetric quantum mechanics on vortex moduli spaces*. (December 20).

3.5 LARSyS Lecture Series in Engineering and Mathematics

No talks were organized in 2013.

3.6 Operator Theory, Complex Analysis and Applications Seminar

The following talks were given in 2013:

- **Petr Siegl**, Universidade de Lisboa. *Spectral analysis of some non-self-adjoint operators* (January 17).
- **Pedro Patrício**, Universidade do Minho. *Generalized invertibility in rings: some recent results* (February 18).
- **Cristina Câmara**, Instituto Superior Técnico. *A Riemann-Hilbert approach to Toeplitz operators and the corona theorem* (March 21).
- **Gabriel Lopes Cardoso**, Instituto Superior Técnico. *A light introduction to supersymmetry* (April 18).
- **Sérgio Mendes**, Instituto Universitário de Lisboa, ISCTE-IUL. *Non-commutative summands of the C^* -algebra $C_r^*SL_2(\mathbb{F}_2((\varpi)))$* (May 16).
- **Nelson Faustino**, Universidade de Coimbra. *Berezin Calculus over Weighted Bergman Spaces of Polyanalytic type* (June 20).
- **David Krejcirik**, Nuclear Physics Institute ASCR, Czech Republic. *The Brownian traveller on manifolds* (July 18).

- **Carl Cowen**, Indiana University-Purdue University Indianapolis, USA. *Rota's Universal Operators and Invariant Subspaces in Hilbert Spaces* (July 18).
- **Sergey Naboko**, University of Kent and St.Petersburg State University. *Spectral analysis of Jacobi Matrices and asymptotic properties of orthogonal polynomials* (November 6).
- **Abdelhamid Boussejra**, Université Ibn Tofail, Kenitra, Morocco. *The Hua operators on homogeneous line bundles over bounded symmetric domains of tube type* (November 14).
- **Antti Perälä**, University of Helsinki. *Optimal bounds for analytic projections* (December 4).

3.7 Partial Differential Equations Seminar

The following talks were given in 2013:

- **Filippo Cagnetti**, Instituto Superior Técnico. *A new method for large time behavior of convex Hamilton-Jacobi equations* (February 14).
- **Carlo Mariconda**, Università degli Studi di Padova. *Non occurrence of the Lavrentiev phenomenon for scalar multi-dimensional variational problems* (February 25).
- **Ana Ribeiro**, Universidade Nova de Lisboa. *Existence of solutions for non level-convex problems in the supremal form* (April 17).
- **Diego Marcon Farias**, Instituto Superior Técnico. *A quantitative log-Sobolev inequality for a two parameter family of functions* (April 24).
- **Farid Bozorgnia**, Instituto Superior Técnico. *Optimal partitions for first eigenvalue; numeric and some related problems* (June 4).
- **Leonard Monsaingeon**, Carnegie Mellon University. *Relaxation to Planar Travelling Waves in Inertial Confinement Fusion* (July 2).
- **Edgard Pimentel**, Instituto Superior Técnico. *Existence of classical solutions for time dependent mean-field games* (November 12).

3.8 String Theory Seminar

The following talks were given in 2013:

- **Dimitrios Zoakos**, University of Porto. *Holographic flavor in Chern-Simons-Matter theories* (April 8).

- **Jorge Russo**, Universitat de Barcelona. *Evidence for Large N phase transitions in $N = 2^*$ theory* (April 29).
- **Ivo Sachs**, Ludwig-Maximilians-Universität München. *Homotopy Algebras and String Field Theory* (May 6).
- **Diego Bombardelli**, Universidade do Porto. *Thermodynamic Bethe Ansatz and double-wrapping corrections for non-supersymmetric deformations of AdS/CFT* (May 20).
- **Stefano Giusto**, Università di Padova. *D-brane geometries and black hole microstates* (June 3).
- **Veselin Filev**, Dublin Institute for Advanced Studies. *Magnetic Catalysis in compact spaces* (June 7).
- **Richard Szabo**, Heriot-Watt University Edinburgh. *Quantization of non-geometric flux backgrounds* (June 11).
- **Oscar Varela**, University of Utrecht. *Electric/magnetic duality in AdS₄ / CFT₃* (June 28).
- **Madalena Lemos**, Stony Brook University. *The Conformal Bootstrap Program in $d = 4$* (July 11).
- **Ricardo Vaz**, Stony Brook University. *The Resurgent Quartic Matrix Model: A Progress Report* (July 11).
- **Ricardo Couso Santamaria**, Universidade de Santiago de Compostela. *Resurgence and the Topological String* (July 11).
- **Óscar Dias**, Instituto Superior Técnico. *Gravitational Turbulence* (October 14).
- **Boris Pioline**, CERN Geneva. *Quantum Hypermultiplet Moduli Spaces in $N = 2$ String Vacua* (October 21).
- **Álvaro Osório**, Instituto Superior Técnico. *Regularizing extremal black branes in gauged supergravity* (November 4).
- **Paul Richmond**, University of Oxford. *Localization on Three-Manifolds* (November 25).
- **David Berman**, Queen Mary College London. *Duality Symmetric String and M-Theory* (December 2).
- **Kiril Hristov**, Università degli Studi di Milano-Bicocca. *Supersymmetric black holes in AdS₄ and their CFT duals* (December 9).

3.9 Topological Quantum Field Theory Club

The following talks were given in 2013:

- **John Huerta**, Instituto Superior Técnico.
Introduction to anomalies (February 6).
Anomalies II (February 27).
Anomalies III (March 13).
Anomalies IV (April 3).
- **Aleksandar Mikovic**, Universidade Lusófona. *Categorification of Spin Foam Models* (March 20).
- **John Huerta**, Instituto Superior Técnico.
Quantum Field Theory I (April 10).
QFT II (April 17).
QFT III (April 24).
QFT IV (June 14).
QFT V (June 20).
- **Travis Willse**, The Australian National University. *Groups of type G_2 and exceptional geometric structures in dimensions 5, 6, and 7* (August 29).
- **Nuno Freitas**, Universität Bayreuth. *The Fermat equation over totally real number fields* (September 30).
- **John Huerta**, Instituto Superior Técnico. *What can higher categories do for physics?* (November 27).
- **Nuno Costa Dias**, Universidade Lusófona and GFM/Universidade de Lisboa. *Quantum mechanics in phase space: The Schrödinger and the Moyal representations* (December 4).
- **Carlos Guedes**, Albert-Einstein-Institut, Potsdam-Golm. *The non-commutative Fourier transform for Lie groups* (December 11).
- **Marko Vojinovic**, Universidade de Lisboa. *Introduction to renormalization in QFT* (December 18).

3.10 Working Seminar on Contact/Symplectic Topology/Geometry

The following talks were given in 2013:

- **Daniele Sepe**, Centro de Análise Matemática, Geometria e Sistemas Dinâmicos. *On complete isotropic realisations of Poisson manifolds* (June 4).

- **Daniele Sepe**, Centro de Análise Matemática, Geometria e Sistemas Dinâmicos. *Singular integral affine structures and integrable Hamiltonian systems* (June 6).
- **Daniele Sepe**, Centro de Análise Matemática, Geometria e Sistemas Dinâmicos. *From semi-toric systems to Hamiltonian S^1 -spaces* (June 11).

4 Conferences and short courses

The following Conferences and Short Courses were organized or co-organized by members of the Center in 2013:

Iberian Strings 2013

Instituto Superior Técnico, Lisbon, Portugal, January 22 – 25, 2013

Organizing committee: Inês Aniceto (CAMGSD/IST), Gabriel Cardoso (CAMGSD/IST), Michele Cirafici (CAMGSD/IST), Sebastian Guttenberg (CAMGSD/IST), Nicolas Orantin (CAMGSD/IST), Ricardo Schiappa (CAMGSD/IST).

5th IST Lectures on Algebraic Geometry and Physics – 2013

Instituto Superior Técnico, Lisbon, Portugal, February 7 – 8, 2013

Organizing committee: José Mourão (CAMGSD/IST), João Pimentel Nunes (CAMGSD/IST).

Workshop – Mathematics and Physics of Aerosols

Universidade de Évora, Portugal, May 23, 2013

Organizing committee: Carlos Herdeiro (Universidade de Aveiro), Fernando Pestana da Costa (CAMGSD and Universidade Aberta), Hugo Silva (Universidade de Évora), Joaquim Correia (Universidade de Évora), Manual Oliveira (Universidade de Évora), Rafael Sasportes (CAMGSD and Universidade Aberta),

Mira Fernandes Lectures on Mathematical Relativity

Instituto Superior Técnico, Lisbon, Portugal, June 17 – 20, 2013

Organizing committee: José Natário (CAMGSD/IST).

Lectures:

- **Hans Ringström**, KTH - Royal Institute of Technology.
On the stability and topology of the universe - I (June 17).
- **Hans Ringström**, KTH - Royal Institute of Technology.
On the stability and topology of the universe - II (June 18).
- **Hans Ringström**, KTH - Royal Institute of Technology.
On the stability and topology of the universe - III (June 19).
- **Hans Ringström**, KTH - Royal Institute of Technology.
On the stability and topology of the universe - IV (June 20).

XIV Lisbon Summer Lectures in Geometry

Instituto Superior Técnico, Lisbon, Portugal, June 24 – 26, 2013

Organizing committee: Miguel Abreu (CAMGSD/IST), Rosa Sena Dias (CAMGSD/IST), José Mourão (CAMGSD/IST), João Pimentel Nunes (CAMGSD/IST).

Lectures:

- **Song Sun**, Imperial College. *Kähler-Einstein metrics and stability - I* (June 24).
- **Song Sun**, Imperial College. *Kähler-Einstein metrics and stability - II* (June 25).
- **Song Sun**, Imperial College. *Kähler-Einstein metrics and stability - III* (June 26).
- **Song Sun**, Imperial College. *Kähler-Einstein metrics and stability - IV* (June 26).

IST courses on Algebraic Geometry 2013

Universidade do Porto, Portugal, June 25 – 28, 2013

Organizing committee: Peter Gothen (Universidade do Porto), Margarida Mendes Lopes (CAMGSD/IST).

Lectures:

- **Steven Bradlow**, University of Illinois at Urbana-Champaign.
Geometry of Higgs Bundles I (June 25).
Geometry of Higgs Bundles II (June 26).
Geometry of Higgs Bundles III (June 27).
Geometry of Higgs Bundles IV (June 28).
- **Oscar García-Prada**, Instituto de Ciencias Matemáticas, Madrid.
Geometry of Higgs Bundles I (June 25).
Geometry of Higgs Bundles II (June 26).
Geometry of Higgs Bundles III (June 27).
Geometry of Higgs Bundles IV (June 28).

2-Day OTCA 2013

Universidade do Minho, Guimarães, Portugal, July 15-16, 2013

Organizing committee: Cristina Câmara (CAMGSD/IST), Cristina Diogo (ISCTE/IUL and CAMGSD/IST), Teresa Malheiro (CMAT/UMinho), Paulo Pereira (CMAT/UMinho)

Nonlinear Wave Equations

Instituto Superior Técnico, Lisbon, Portugal, September 2 – 6, 2013

Organizing committee: Fabrice Planchon (Université Nice), Pierre Raphaël (Université Nice), Pedro Girão (CAMGSD/IST), Jorge Drumond Silva (CAMGSD/IST)

IX Avogadro Meeting on String Theory, Supergravity and Gauge Theories

Scuola Internazionale Superiore di Studi Avanzati, Trieste, Italy, December 18 – 20, 2013

Organizing committee: E. Tonni (SISSA & INFN), R. Valandro (ICTP & INFN), M. Caldarelli (Southampton University), Michele Cirafici (CAMGSD/IST), V. Forini (Humboldt Universität), D. Francia (SNS & INFN)

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, (Non-)Displaceable Lagrangian Toric Fibers, Geometry and Topology Seminar, CMUP, Porto, February 8, 2013.
- Miguel Abreu, Dynamical Convexity and Elliptic Orbits for Reeb Flows, Workshop on Conservative Dynamics and Symplectic Geometry, IMPA, Rio de Janeiro, September 2-6, 2013.
- Artur Alho, Density inhomogeneities in scalar field cosmologies: a dynamical system approach, The London Relativity and Cosmology Seminar, Queen Mary University of London, November 27, 2013
- Inês Aniceto, Resurgent Analysis in String Theory, Iberian Strings, IST, Portugal, January 22, 2013.
- Inês Aniceto, Resurgent Analysis in String Theory, Seminar, IPhT Saclay, France, February 22, 2013.
- Inês Aniceto, Resurgence Theory, Mini-course, Universidade do Porto, Portugal, May 7–9, 2013.
- Inês Aniceto, Resurgent Analysis in String Theory, String Theory Universe Workshop, Bern University, Switzerland, September 2, 2013.
- Inês Aniceto, Resurgence in Quantum Theories: Perturbative Theory and Beyond, Theory Seminar, Universitat de Barcelona, Spain, October 24, 2013.
- Inês Aniceto, Resurgence in Quantum Theories: Perturbative Theory and Beyond, Seminar, SLAC-National Accelerator Laboratory, USA, November 13, 2013.
- Inês Aniceto, Uncovering Exact Results in Perturbative Quantum Theories, Colloquium, San Francisco State University, USA, November 18, 2013.
- Inês Aniceto, Resurgence in Quantum Theories: Perturbative Theory and Beyond, Seminar, University of Minnesota at Minneapolis, USA, November 21, 2013.
- Cristina Câmara, A Riemann-Hilbert approach to Toeplitz operators and the corona theorem, Mathematical aspects of the physics of non self adjoint operators, ICMS, Edinburgh, UK, March 11-15, 2013.

- Cristina Câmara, On some properties of the kernels of Toeplitz operators, Workshop on Operator Theory and Complex Analysis, Lille, France, May 27-29, 2013.
- Cristina Câmara, On some properties of the kernels of Toeplitz operators, Meeting on Riemann-Hilbert problems and their applications, Reading, UK, May 29-30, 2013.
- Cristina Câmara, A Riemann-Hilbert approach to Toeplitz operators and the corona theorem, Operators on Banach Spaces, Castro Urdiales, Spain, June 10-14, 2013.
- Cristina Câmara, One-sided invertibility, corona problems and applications to Toeplitz operators, Sz.-Nagy Centennial Conference, Szeged, Hungary, June 24-28, 2013.
- Cristina Câmara, Convolution equations via Riemann-Hilbert problems, LARSyS Annual Meeting, Lisbon, July 4-5, 2013.
- Cristina Câmara, Kernels of Toeplitz operators, near invariance and model spaces, Journées d'Analyse 2013, Université Bordeaux 1, France, October 9-11, 2013.
- Michele Cirafici, Framed BPS quivers and line defects in $N = 2$ QFT, Queen Mary University of London, UK, October 2, 2013.
- Michele Cirafici, Problem solving with SuSy, LARSyS Annual Meeting, Lisbon, July 2013.
- Michele Cirafici, Defects in cohomological gauge theory and Donaldson-Thomas invariants, Vector Bundles on Algebraic Curves 2013: Hilbert Schemes, Sheaves and Representations, SISSA, Trieste, Italy, June 17-21, 2013.
- João L. Costa, Strong Cosmic Censorship with a Cosmological Constant II, VI Black Holes Workshop, Braga, Portugal, December 2013.
- L. Filipe Costa, Dynamics of spinning test bodies in general relativity - center of mass, momentum, and the problem of the representative worldline, Invited Seminar at the Institute of Theoretical Physics, Charles University, Czech Republic, December 17, 2013
- Fernando P. da Costa, Smoluchowski's coagulation system and related models, CIM International Conference on the Mathematics of Energy and Climate Change, Lisbon, March 2013.

- Fernando P. da Costa, Self-similarity in Smoluchowsk's coagulation equations: some results and open problems, Seminario del Departamento de Matemáticas Fundamentales, Universidad Nacional de Educación a Distancia, Madrid, Spain, April 2013.
- Fernando P. da Costa, Coagulation and clustering dynamics, LARSyS Annual Meeting 2013, Lisbon, July 2013.
- Fernando P. da Costa, On a model of cluster annihilation, Particle Systems and PDEs II, Universidade do Minho, Braga, December 2013.
- Fernando P. da Costa, On a model of cluster annihilation, Some Prospective Aspects in Mathematics and Statistics, Universidade de Évora, Évora, December 2013.
- Radoslaw Czaja, Nonautonomous dynamical systems and their pull-back attractors, Universidade do Porto, March 15, 2013.
- Gonçalo A. S. Dias, Freely Floating Bodies in a Two-Layer Fluid, International Conference and Advanced School Planet Earth, Dynamics, Games, and Science II (DGS II 2013), Lisbon, Portugal, September 4, 2013.
- Cristina Diogo, Criteria for factorability for a class of triangular matrix functions, Centro de Estudos e de Desenvolvimento da Matemática no Ensino Superior, Faro, January 9, 2013.
- Cristina Diogo, Wiener-Hopf factorization for a class of analytic matrix symbols, 15th Workshop on Applications and Generalizations of Complex Analysis, Aveiro, Portugal, Lisbon, March 8-9, 2013.
- Cristina Diogo, Wiener-Hopf factorization for a class of analytic matrix symbols associated with finite interval convolution operators, Operator Theory Seminar, Ljubljana, Slovenia, May 23, 2013.
- Cristina Diogo, Fredholm properties for a class of Toeplitz operators with symbols with a gap around zero, Sz.-Nagy Centennial Conference, Szeged, Hungary, June 24-28, 2013.
- Cristina Diogo, Factorization for a class of triangular matrix functions and related Riemann-Hilbert problems, 9th Workshop on Functional Analysis and its Applications, Nemecka, Slovakia, September 9-14, 2013.
- Jorge Drumond Silva, Waves and Dispersion, LARSyS Annual Meeting, Lisbon, July 5, 2013.

- Jorge Drumond Silva, Nonlinear Schrödinger Equation with Time Dependent Potential: Large Time Properties, Workshop on Nonlinear Wave Equations, IST, September 6, 2013.
- Sebastian Guttenberg, Extended Symmetries in the Pure Spinor Conformal Field Theory, Research Seminar, ICTP SAIFR - São Paulo, Brazil, April 25, 2013.
- Pedro Lopes, Stability of hyperfinite knots, Seminário de Geometria, Dep. Matemática, Universidade de Coimbra, July 2, 2013
- Gabriel Lopes Cardoso, Fluids, Black Holes and Strings, LARSyS Annual Meeting, Lisbon, July 4, 2013
- Gabriel Lopes Cardoso, The holomorphic anomaly equation and the Hesse potential, 2-Day OTCA 2013, Guimarães, Portugal, July 15, 2013.
- Gabriel Lopes Cardoso, Deformed special geometry: the Hesse potential and the holomorphic anomaly equation, Workshop The String Theory Universe, Bern, Switzerland, September 2, 2013.
- Gabriel Lopes Cardoso, Indefinite theta functions and black hole partition functions, VI Workshop on Black Holes, Braga, Portugal, December 18, 2013.
- Gabriel Lopes Cardoso, mini-course Introduction to BPS black holes, XXXI Heidelberg Physics Graduate Days, University of Heidelberg, Germany, October 7-11, 2013.
- Rafael Luís, Local bifurcation in one dimensional nonautonomous periodic difference equations, Progress on Difference Equations 2013 - PODE 2013, Bialystok, Poland, 21-26 July, 2013
- Marco Mackaay, $\mathfrak{sl}(3)$ -web algebras and categorified skew Howe duality, Geometry and Topology Seminar, University of Southern California, February 11, 2013.
- Marco Mackaay, $\mathfrak{sl}(3)$ -web algebras and categorified skew Howe duality, Geometry and Topology Seminar, California Institute of Technology, February 15, 2013.
- Marco Mackaay, $\mathfrak{sl}(3)$ -web algebras and categorified skew Howe duality, Columbia Symplectic Geometry, Gauge Theory, and Categorification Seminar, Columbia University, February 22, 2013.
- Marco Mackaay, $\mathfrak{sl}(3)$ -web algebras and categorified skew Howe duality, Séminaire d'algèbre et de géométrie, University of Caen, France, May 7, 2013.

- Marco Mackaay, The $\mathfrak{sl}(N)$ -web categories and categorified skew Howe duality, Journée de Topologie, Institut de Mathématiques de Jussieu - ANR ModGroup, e Université Paris Diderot (Paris 7), France, July 11, 2013.
- Marco Mackaay, An introduction to link homology, Colloquium, Uppsala University, Sweden, September 2, 2013.
- Marco Mackaay, The $\mathfrak{sl}(N)$ -web categories and categorified skew Howe duality, Algebra and Geometry seminar, Uppsala University, Sweden, September, 9, 2013.
- Léonard Monsaingeon, Linear relaxation to planar travelling waves in Inertial Confinement Fusion, SIAM Conference on Analysis of Partial Differential Equations 2013, Orlando, USA, December 9, 2013.
- Marco Morandotti, Renormalized Energy and Dynamics for a System of Screw Dislocations, PDE seminar, Universidade Nova de Lisboa, May 15, 2013.
- Marco Morandotti, Dynamics for a System of Screw Dislocations (poster), CNA Summer School Topics in Nonlinear PDEs and Calculus of Variations, and Applications in Materials Science, Carnegie Mellon University, Pittsburg, USA, May 30 - June 7, 2013.
- Marco Morandotti, Dynamics for a System of Screw Dislocations (poster), SIAM Conference on Mathematical Aspects of Material Science, Philadelphia, USA, June 9-12, 2013.
- Marco Morandotti, Dynamics for a system of screw dislocations, BMS Intensive Course on Evolution Equations and their Applications, TU Berlin, November 28, 2013.
- José Mourão, Tropicalization in symplectic geometry and degeneration to real polarizations, Conference on Tropical aspects in Geometry and Topology, Max Planck Institute for Mathematics, Bonn, Germany, September 2-6, 2013.
- José Mourão, Complex time evolution in geometric quantization, Faculty of Sciences and Technology, University of Macau, October 16, 2013.
- José Mourão, Geodesics on the space of Kähler metrics, geometric tropicalization and quantization, Mini-Workshop on Geometry, Chinese University of Hong Kong, October 16-17, 2013.
- José Mourão, Decomplexification of integrable systems, quantization and Kähler geometry, International School on Geometry, Groupoids and Quantization, University of Hong Kong, November 2-5, 2013.

- José Mourão, $\text{Diff}_c(S^1)$ in the context of the complexified Hamiltonian flows on T^*S^1 and the annulus semigroup of Segal, International Workshop on Geometry and Representation Theory, University of Hong Kong, November 4-6, 2013.
- José Mourão, Imaginary time flow in geometric quantization, degeneration to real polarizations and tropicalization, WaGaRy – Workshop on Differential Geometry, Polish Academy of Sciences, December, 18, 2013.
- Milena Pabiniak, The Arnold Conjectures and an introduction to the generating functions technique, Topology And Geometric Group Theory Seminar, Cornell University, USA, April 25 2013.
- Milena Pabiniak, Lower bounds on Gromov width of coadjoint orbits through the Gelfand-Tsetlin pattern, Geometry and Topology Seminar, Universidade do Porto, July 12, 2013.
- Milena Pabiniak, Arnold Conjectures and introduction to the generating functions technique, Algebra and Geometry Seminar, University of Pavia, Italy, November 27, 2013.
- Roger Picken, Categorification and its uses, LARSyS Annual Meeting, Lisbon, July 4, 2013.
- Paulo R. Pinto, On semisimplicity of amenable operator algebras, Université Hassan I, Morocco, June 13, 2013.
- Paulo R. Pinto, On semisimplicity of amenable operator algebras, Workshop Analyse Harmonique et Inégalités Fonctionnelles, Université Moulay Ismail, Meknès, Morocco, June 19-22, 2013.
- Paulo R. Pinto, On pro- C^* -algebras of profinite groups, Conference Noncommutative Geometry and applications, Poiana Brasov, Romania, September 2-9, 2013.
- Pedro Resende, Inverse semigroups and groupoids via quantales, Edinburgh Workshop on Semigroup Representations, Edinburgh, UK, April 10-12, 2013
- Pedro Resende, Inverse semigroups and groupoids via quantales, Workshop on Algebraic Structures and Semigroups, Universidade de Lisboa, July 5, 2013.
- Edgard Pimentel, Regularity for mean-field games in the subquadratic case, DGS II 2013 - International Conference and Advanced School Planet Earth, Dynamics, Games and Science, Lisbon, Portugal, September 2, 2013.

- Edgard Pimentel, Regularity for the mean-field games in the subquadratic case, Mean-Field Games and Related Topics 2, Università degli studi di Pádova, Italy, September 4-6, 2013.
- Edgard Pimentel, Time dependent mean-field games and applications, CMUP Seminars, Universidade do Porto, Portugal, December 13, 2013.
- Carlos Rocha, Morse decompositions for Sturm global attractors, plenary talk, ICMC Summer Meeting on Differential Equations, Universidade de São Paulo em São Carlos, February 7, 2013.
- Carlos Rocha, Sturm global attractors for semilinear parabolic equations, invited talk, First International Conference on Dynamics of Differential Equations, Atlanta, USA, March 17, 2013.
- Carlos Rocha, Pattern Dynamics, Robotics and Systems in Engineering and Science, LARSyS Annual Meeting, Lisbon, July 4, 2013.
- Carlos Rocha, Sturm global attractors and Morse decompositions, invited lecture, Equadiff 13, Prague, Czech Republic, August 28, 2013.
- Silvia Sabatini, Semi-toric systems on compact symplectic manifolds, Conference on Beyond Toric Integrability, Centre Bernoulli, EPFL, December 11, 2013.
- Silvia Sabatini, Classification problems in equivariant symplectic geometry, Higher Differential Geometry Seminar, Max Planck Institute for Mathematics, November 26, 2013.
- Silvia Sabatini, Classification problems in equivariant symplectic geometry, Geometry and Algebra, Geometry and Analysis Seminar, Utrecht University, November 19, 2013
- Silvia Sabatini, Computing the equivariant cohomology ring of flag varieties using their symplectic structure, Séminaire Groupes de Lie et espaces des modules, Université de Genève, December 3, 2013.
- Rafael Sasportes, The *cluster eating* coagulation system, CIM International Conference on the Mathematics of Energy and Climate Change, Lisbon, March 25, 2013.
- Ricardo Schiappa, Resurgent Transseries: Beyond (Large N) Perturbative Expansions, CENTRA, Instituto Superior Técnico, Portugal, 25 de Outubro de 2013.
- Ricardo Schiappa, Resurgent Transseries: Beyond (Large N) Perturbative Expansions, Theory Division, CERN, Switzerland, 5 de Dezembro de 2013.

- Daniele Sepe, Integral affine geometry: from fundamentals to applications and back, Staff Colloquium, Utrecht University, The Netherlands, February 7, 2013.
- Daniele Sepe, Singular integral affine structures of focus-focus singularities, Hamiltonian Dynamics Seminar, EPFL, Switzerland, March 25, 2013.
- Hugo Tavares, Existence and orbital stability of the ground states with prescribed L^2 -norm for the NLS on bounded domains, University of Torino, Italy, November 20, 2013.
- Hugo Tavares, Existence and symmetry results for competing variational systems , University of Aveiro, Portugal, October 31, 2013.
- Gabriele Terrone, Homogenization of certain optimal control problems, International Conference Planet Earth, Dynamics, Games, and Science II (DGS II 2013), Lisbon, Portugal, September 2, 2013.
- Juha Videman, On John's problem on freely floating bodies, ICES Seminar, UT Austin, USA, April 4, 2013.
- Juha Videman, Wave interaction with floating structures, LARSyS Annual Meeting, Lisbon, July 4, 2013.

6 Postdoctoral program and research fellows

The Center started its own postdoctoral program in the academic year 1998/99. Positions are for one year, with the possibility for extension for another year upon mutual agreement. Applicants must have a PhD degree in mathematics, preferably earned within the two-year period immediately preceding the opening date of the position. To be selected an applicant must show very strong research promise in one of the main areas of activities of the Center. There are no teaching duties associated with these positions. They are announced internationally in different ways including the European Commission Euroaxess, the European Mathematical Society and the American Mathematical Society web sites, leading to about 200 applicants every year.

The Center hosts also postdocs financed by other programs. The list of all our postdoctoral fellows since 1998 is available at:

<http://camgsd.ist.utl.pt/posdoc.php.en>

The following fellows stayed at the Center during 2013:

- Artur Alho, PhD in Mathematics, Universidade do Minho, 2012. Research areas: General Relativity: future and past asymptotics of cosmological models, spherically symmetric collapse with positive cosmological constant. Supported by an FCT postdoctoral grant. 2.10 (Apr. 2013–Mar. 2016).
- Hassan Alishah, PhD in Mathematics, Instituto Superior Técnico, 2012. Research Areas: KAM theory, geometric mechanics, Symplectic and related geometries including Presymplectic, Poisson and Dirac. Postdoctoral fellow financed by an FCT project grant (Oct. 2013–Oct. 2014)
- Inês Aniceto, PhD in Physics, Brown Univ., USA, 2009. Research areas: string theory. Supported by CAMGSD (Sep. 1, 2009–Aug. 31, 2010) and by an FCT postdoctoral grant (Sep. 1, 2010–Aug. 31, 2013).
- João Oliveira Baptista, PhD in Mathematical Physics, University of Cambridge, UK, 2006. Research areas: complex geometry, moduli spaces of solitons, gauge theory, quantum field theory. Supported by an FCT postdoctoral grant (Mar. 2012– Jun. 2013).
- Farid Bozorgnia, PhD in Applied Mathematics, Royal Institute of Technology, Stockholm, Sweden, 2009. Research Areas: Partial Differential Equations (Numerical Analysis and Theory), Calculus of Vari-

ations, Spectral Theory. Supported by the UT Austin/Portugal Program (Aug. 2010–Nov. 2011, June 2012–Mar. 2014).

- 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. 2009–Feb. 2011) and by the UT Austin/Portugal Program (Mar. 2011–Mar. 2013).
- Michele Cirafici, PhD in Physics, SISSA Trieste, 2004. Research areas: string theory, quantum field theory, geometry. Supported by the CIÊNCIA 2008 Program (Sep. 2009–Aug. 2014).
- Filipe Costa, PhD in Physics, Universidade do Porto, 2012. Research areas: General Relativity: gravitomagnetic effects, dynamics of extended test bodies, gravito-electromagnetic analogies. Supported by an FCT postdoctoral grant (May 2013–April 2016).
- 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. 2009–Aug. 2014).
- Gonçalo Aprá Dias, PhD in Theoretical Physics, IST, 2008. Research areas: Fluid Mechanics, Water Waves, Analysis. Supported by an FCT postdoctoral grant (Oct. 2010–Sep. 2016).
- Óscar Dias, PhD in Physics, IST, 2003. Research areas: General Relativity, Differential Geometry, Gravitational Aspects of String Theory. Supported by the FCT Investigator 2012 Program through a Development Grant (Sep. 2013–Aug. 2018)
- 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).
- João Esteves, PhD in Physics, IST, 2011. Research area: Symplectic geometry, geometric quantization and mathematical physics. Supported by a CAMGSD postdoctoral grant (Nov. 2011–Jan. 2012) and by an FCT postdoctoral grant (Feb. 2012–Jan. 2015).
- Rita Ferreira, PhD in Mathematics, Carnegie Mellon University and Universidade Nova de Lisboa, 2011. Research areas: calculus of variations, homogenization, continuum mechanics, partial differential equations. Supported by an FCT postdoctoral grant (Nov. 2012–Nov. 2015).

- Sebastian Guttenberg, PhD in Physics, Technical Univ. Vienna, Austria, 2007. Research areas: string theory. Supported by an FCT postdoctoral grant (Sep. 1, 2010–Aug. 31, 2013).
- Jinjun Li, PhD in Mathematics, South China University of Technology (Guangzhou), 2012. Research areas: fractal geometry and dynamical systems. Supported by an FCT postdoctoral grant (Oct. 2012–Abr. 2013).
- Matias del Hoyo, PhD in Mathematics, Universidad de Buenos Aires, 2009. Research areas: algebraic topology, category theory, poisson geometry. Supported by an FCT postdoctoral grant (Oct. 2011 – Jan. 2013)
- John Huerta, PhD in Mathematics, University of California, Riverside, 2011. Research areas: Foundations of supersymmetry, applying higher gauge theory to superstrings, supermembranes and supergravity. Supported by a CAMGSD postdoctoral grant (Jan. 2013–Dec. 2014)
- Alessia Mandini, PhD in Mathematics, Univ. Bologna, Italy, 2007. Research areas: symplectic geometry. Supported by CAMGSD funding (Sep. 1, 2007–May 31, 2009), and by an FCT postdoctoral grant (Jun. 2009 – Aug. 2013).
- 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).
- Leonard Monsaingeon, PhD in Mathematics, University of Toulouse 3, 2011. Research areas: Elliptic-parabolic PDE's, free boundaries and wave propagation, reaction-diffusion, mass transport methods. Supported by an FCT postdoctoral grant (Sep. 2013–Sep.2016).
- Marco Morandotti, PhD in Mathematics, SISSA, 2011. Research areas: Fluid Mechanics, Partial Differential Equations, Mathematical Modeling, Engineering Mathematics. Supported by a CMU-Portugal project grant (Apr. 2013–Ago. 2014)
- Levon Nurbekian, PhD in Mathematics, Instituto Superior Técnico, 2012. Research areas: calculus of variations, optimal control, infinite dimensional weak KAM theory, optimal transportation, gradient flows in metric spaces. Supported by CMU-Portugal program (Jun. 2012–Jun. 2015).

- Nicolas Orantin, PhD in Mathematical Physics, CEA-Saclay, France, 2007. Research areas: string theory. Supported by an FCT postdoctoral grant (Sep. 2010–Jan. 2013).
- Milena Pabiniak, PhD in Mathematics, Cornell University, 2012. Research areas: Equivariant cohomology for Hamiltonian group actions. Gromov width of coadjoint orbits. Displaceable and non-displaceable Lagrangian subspaces. Supported by an FCT postdoctoral grant (Jan. 2013–Dec. 2016).
- Stefania Patrizi, PhD in Mathematics, Sapienza Università di Roma, Italy, 2010. Research areas: analysis, differential equations, homogenization. Supported by the UT Austin/Portugal Program (Apr. 2010–Jan. 2013).
- Silvia Sabatini PhD in Mathematics, Massachusetts Institute of Technology, 2009. Research areas: Symplectic geometry, equivariant topological invariants of symplectic manifolds with symmetries, completely integrable Hamiltonian systems. Supported by an FCT postdoctoral grant (Sep. 2013–Aug. 2016)
- Daniele Sepe, PhD in Mathematics, University of Edinburgh, UK, 2011. Research areas: topology, symplectic and Poisson geometry of finite dimensional integrable systems. Affinely flat geometry. Supported by CAMGSD in 2011 and by an FCT postdoctoral grant (Jan. 2012–Jul. 2013).
- Hugo Tavares, PhD in Mathematics, Universidade de Lisboa, 2010. Research areas: Partial Differential Equations, Variational Methods. Supported by the FCT Investigator 2012 Program through a Starting Grant (Sep. 2013–Aug. 2018)
- Gabriele 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, 2014).
- Giorgio Trentinaglia, PhD in Mathematics, Utrecht University, 2008. Research areas: complex analytic geometry, Hodge theory, Mumford–Tate groups; Lie groups and groupoids, orbifolds, foliations, differentiable stacks; representation theory, Tannaka duality, categorical algebra. Supported by an FCT postdoctoral grant (Oct. 2012–Oct. 2015).
- Alfonso Zamora PhD in Mathematics, Universidad Complutense de Madrid, 2013. Research areas: Algebraic geometry, Moduli spaces, GIT, Stability conditions. Supported by an FCT project grant (Nov. 2013–Oct. 2014)

7 Doctoral supervision

The following doctoral degrees have been concluded in 2013 under supervision of members of the Center:

- Marcin Szamotulski, PhD in Mathematics, IST, March 2013
Thesis title: Galois Theory for H-Extensions
Supervised by Roger Picken
- Celestino Coelho, PhD in Mathematics, Universidade do Algarve, April 2013
Thesis title: Numerical and Stochastic Analysis of Turbulent Equations in Climate Modeling
Supervised by Juha Videman
- Vardan Voskanyan, PhD in Mathematics, IST, May 2013
Thesis title: Extended mean field games
Supervised by Diogo Gomes
- Diego Marcon Farias, PhD in Mathematics, IST, May 2013
Thesis title: Weak Kam and Aubry-Mather Theories in an Optimal Switching Setting
Supervised by Diogo Gomes
- Daniel Tubbenhauer, PhD in Mathematics, Georg-August-Universität Göttingen, Germany, July, 2013
Thesis title: Categorification and applications in topology and representation theory
Co-supervised by Marco Mackaay.
- Verónica Quítalo, PhD in Mathematics, University of Texas at Austin, July 2013
Thesis title: Regularity of a segregation problem with an optimal control operator
Co-supervised by Diogo Gomes
- Ricardo de Lima Ribeiro, PhD in Applied Mathematics, Universidade de São Paulo, Brasil, October 2013
Thesis title: A priori estimates for mean-field games with logistic population dynamics
Co-supervised by Diogo Gomes
- Edgard Almeida Pimentel, PhD in Mathematics, IST, December 2013
Thesis title: Time Dependent Mean-Field Games
Supervised by Diogo Gomes

8 Publications in 2013

8.1 Publications which appeared in 2013

Books & Monographs

- [1] L. Barreira. *Dimension Theory of Hyperbolic Flows*. Springer Monographs in Mathematics. Springer, 2013.
- [2] L. Barreira and Ya. Pesin. *Introduction to Smooth Ergodic Theory*, volume 148 of *Graduate Studies in Mathematics*. AMS, 2013.
- [3] L. Barreira and C. Valls. *Dynamical Systems: An Introduction*. Universitext. Springer, 2013.
- [4] L. Barreira and C. Valls. *Théorie des systèmes dynamiques: Une introduction*. Enseignement Sup - Mathématiques. EDP Sciences, 2013.
- [5] J. P. Santos. *Cálculo numa variável real*. IST Press, 2013.

Books (edited)

- [1] F. Pestana da Costa, J. Teixeira Pinto, and J. Buescu, editors. *Matemática do Planeta Terra*. IST Press, 2013. 554 p.

Articles in refereed international journals

- [1] M. Abreu and L. Macarini. Remarks on Lagrangian intersections in toric manifolds. *Trans. Amer. Math. Soc.*, 365:3851–3875, 2013. arXiv:1105.0640.
- [2] J.F.Alves and M. Málek. Zeta functions and topological entropy of periodic nonautonomous dynamical systems. *Discrete Contin. Dyn. Syst.*, 33(2):465–482, 2013.
- [3] K. Andersen, B. Oliver, and J. Ventura. Fusion systems and amalgams. *Math. Z.*, 274(3-4):1119–1154, 2013.
- [4] J. Angulo Pava, C. Banquet, J. Drumond Silva, and F. Oliveira. The regularized Boussinesq equation: Instability of periodic traveling waves. *J. Differential Equations*, 254(9):3994–4023, 2013.
- [5] S. Anjos and M. Pinsonnault. The homotopy Lie algebra of symplectomorphism groups of 3-fold blow-ups of the projective plane. *Math. Z.*, 275(1-2):245–292, 2013.

- [6] M. Baía, A.C. Barroso, M. Chermisi, and J. Matias. Coupled second order singular perturbations for phase transitions. *Nonlinearity*, 26(5):1271–1312, 2013.
- [7] M. Baía, M. Chermisi, J. Matias, and P.M. Santos. Lower semicontinuity and relaxation of signed functionals with linear growth in the context of \mathcal{A} -quasiconvexity. *Calc. Var. Partial Differential Equations*, 47(3-4):465–498, 2013.
- [8] M. Baía, J. Matias, and P.M. Santos. Characterization of generalized Young measures in the \mathcal{A} -quasiconvexity context. *Indiana Univ. Math. J.*, 62(2):487–521, 2013.
- [9] J.M. Baptista and I. Biswas. Abelian vortices with singularities. *Differential Geom. Appl.*, 31(6):725–745, 2013. arXiv:1207.0863.
- [10] M. Barchiesi, F. Cagnetti, and N. Fusco. Stability of the Steiner symmetrization of convex sets. *J. Eur. Math. Soc. (JEMS)*, 15(4):1245–1278, 2013.
- [11] M. Bardi and G. Terrone. On the homogenization of some non-coercive Hamilton-Jacobi-Isaacs equations. *Commun. Pure Appl. Anal.*, 12(1):207–236, 2013.
- [12] S. Barisch-Dick, G.L. Cardoso, M. Haack, and S. Nampuri. Extremal black brane solutions in five-dimensional gauged supergravity. *J. High Energy Phys.*, 2013(02:103), 2013. arXiv:1211.0832.
- [13] L. Barreira, Y. Cao, and J. Wang. Multifractal analysis of asymptotically additive sequences. *J. Statist. Phys.*, 153(5):888–910, 2013.
- [14] L. Barreira, J. Chu, and C. Valls. Lyapunov functions for general nonuniform dichotomies. *Milan J. Math.*, 81(1):153–169, 2013.
- [15] L. Barreira, D. Dragicevic, and C. Valls. Lyapunov functions for strong exponential contractions. *J. Differential Equations*, 255(3):449–468, 2013.
- [16] L. Barreira, D. Dragicevic, and C. Valls. Lyapunov functions for strong exponential dichotomies. *J. Math. Anal. Appl.*, 399(1):116–132, 2013.
- [17] L. Barreira and C. Valls. Admissibility versus nonuniform exponential behavior for noninvertible cocycles. *Discrete Contin. Dyn. Syst.*, 33(4):1297–1311, 2013.
- [18] L. Barreira and C. Valls. Analytic robustness of parameter-dependent perturbations of difference equations. *Topol. Methods Nonlinear Anal.*, 41(2):335–364, 2013.

- [19] L. Barreira and C. Valls. On the exponential behaviour of non-autonomous difference equations. *Proc. Edinb. Math. Soc. (2)*, 56(3):643–656, 2013.
- [20] L. Barreira and C. Valls. A Perron-type theorem for nonautonomous delay equations. *Cent. Eur. J. Math.*, 11(7):1283–1295, 2013.
- [21] L. Barreira and C. Valls. A Perron-type theorem for nonautonomous difference equations. *Nonlinearity*, 26(3):855–870, 2013.
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Other publications

- [1] E. Colli, C. Possani, and C. Ragazzo. Waldyr Muniz Oliva: da cúpula da Sé à mecânica geométrica. *Matemática Universitária*, (50/51):36–55, 2013.

8.2 Accepted publications (submitted or accepted in 2013)

Articles in refereed international journals

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- [2] S. Barisch-Dick, G. Lopes Cardoso, M. Haack, and A. Véliz-Osorio. Quantum corrections to extremal black brane solutions. *J. High Energy Phys.* arXiv:1311.3136 To appear.
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- [7] I. Biswas, C. Florentino, S. Lawton, and M. Logares. The topology of parabolic character varieties of free groups. *Geom. Dedicata*. arXiv:1204.5924 To appear.
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- [17] A. Dzambic and X. Roulleau. Automorphisms and quotients of quaternionic fake quadrics. *Pacific J. Math.* arXiv:1201.5051 To appear.
- [18] R. El Harti, N.C. Phillips, and P.R. Pinto. Profinite pro-C*-algebras and pro-C*-algebras of profinite groups. *Houston J. Math.* arXiv:1110.3411 To appear.
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- [1] P. Gonçalves, B. Pereira, and J.H. Videman. Error estimates for a coupled continuous-discontinuous FEM for the two-layer shallow water equations. In A. Pinto and D. Zilberman, editors, *Modeling, Dynamics, Optimization and Bioeconomics I*, volume 73 of Springer Proceedings in Mathematics & Statistics. Springer-Verlag. To appear.

8.3 Preprints submitted (not yet accepted) in 2013

- [1] J. Alves, A. Bravo, and H.M. Oliveira. Population dynamics with infinite Leslie matrices. arXiv:1307.4036 Submitted.
- [2] J.F. Alves, A. Bravo, and H.M. Oliveira. Kneading determinants of infinite order linear recurrences. arXiv:1307.3474 Submitted.
- [3] I. Aniceto and R. Schiappa. Nonperturbative ambiguities and the reality of resurgent transseries. arXiv:1308.1115 Submitted.
- [4] P. Antonelli, R. Carles, and J. Drumond Silva. Scattering for nonlinear Schrödinger equation under partial harmonic confinement. arXiv:1310.1352 Submitted.
- [5] I. Biswas, C. Florentino, L. Godinho, and A. Mandini. Symplectic form on hyperpolygon spaces. arXiv:1306.4806 Submitted.
- [6] G. Borot, B. Eynard, and N. Orantin. Abstract loop equations, topological recursion, and applications. arXiv:1303.5808 Submitted.
- [7] E.B. Cabral, S. Elaydi, and R. Luís. Global dynamics of triangular maps. Submitted.
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- [13] R. Carles and J. Drumond Silva. Large time behavior in nonlinear Schrödinger equation with time dependent potential. arXiv:1305.4089 Submitted.
- [14] C. Ciliberto, M. Mendes Lopes, and R. Pardini. The classification of minimal irregular surfaces of general type with $K^2 = 2p_g$. arXiv:1307.6228 Submitted.

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- [16] M. Cirafici. Defects in cohomological gauge theory and Donaldson-Thomas invariants. arXiv:1302.7297 Submitted.
- [17] R. Couso Santamaría, J.D. Edelstein, R. Schiappa, and M. Vonk. Resurgent transseries and the holomorphic anomaly. arXiv:1308.1695 Submitted.
- [18] I. Cruz and M.E Sousa-Dias. Reduction of cluster iteration maps to symplectic maps. arXiv:1307.0467 Submitted.
- [19] R. Czaja. Pullback exponential attractors with admissible exponential growth in the past. Submitted.
- [20] G.A.S. Dias and J.H. Videman. Trapped modes along a periodic array of freely-floating obstacles. Submitted.
- [21] P. Dunin-Barkowski, M. Kazarian, N. Orantin, S. Shadrin, and L. Spitz. Polynomiality of Hurwitz numbers, Bouchard-Mariño conjecture, and a new proof of the ELSV formula arXiv:1307.4729 Submitted.
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- [24] R. Ferreira and D.A. Gomes. On the convergence of finite state mean-field games through Gamma-convergence. Submitted.
- [25] J. Ge, S. Jablan, L. Kauffman, and P. Lopes. Equivalence classes of colorings. Submitted.
- [26] D.A. Gomes, E. Pimentel, and H. Sánchez-Morgado. Time dependent mean-field games in the subquadratic case. arXiv:1310.4766 Submitted.
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- [28] S. Hohloch, S. Sabatini, and D. Sepe. From semi-toric systems to Hamiltonian S^1 -spaces. arXiv:1305.7040 Submitted.
- [29] P. Lopes. On the minimum number of colors for links: change of behaviour at $p = 11$. arXiv:1308.6054 Submitted.
- [30] P. Lopes. Removing Colors $2k$, $2k-1$, and k . arXiv:1308.5278 Submitted.

- [31] M. Mackaay. The $\mathfrak{sl}(n)$ -web algebras and dual canonical bases. arXiv:1308.0566 Submitted.
- [32] M. Mackaay and A.-L. Thiel. Categorifications of the extended affine Hecke algebra and the affine q -Schur algebra $S(n,r)$, for $2 < r < n$. arXiv:1302.3102 Submitted.
- [33] M. Mackaay and A.-L. Thiel. A diagrammatic categorification of the affine Q -schur algebra $S(n,n)$, for $n > 2$. arXiv:1312.5958 Submitted.
- [34] M. Mackaay and Y.Yonezawa. The $\mathfrak{sl}(n)$ web categories. arXiv:1306.6242 Submitted.
- [35] J.F. Martins and R. Picken. Link invariants from finite categorical groups and braided crossed modules. arXiv:1301.3803 Submitted.
- [36] R.A.D. Martins. Spectral C^* -categories and Fell bundles with path-lifting. arXiv:1308.5247 Submitted.
- [37] J.C. Morton and R. Picken. Transformation double categories associated to 2-group actions. arXiv:1401.0149 Submitted.
- [38] J.M. Mourão and J.P. Nunes. On complexified analytic Hamiltonian flows and geodesics on the space of Kahler metrics. arXiv:1310.4025 Submitted.
- [39] J.-E. Nelson and R.F. Picken. Theory of intersecting loops on a torus. arXiv:1309.2187 Submitted.
- [40] J. Neves, M. Vaz Pinto, and R.H. Villarreal. Regularity and algebraic properties of certain lattice ideals. arXiv:1301.4249 Submitted.
- [41] M. Pabiniak. Gromov width of non-regular coadjoint orbits of $U(n)$, $SO(2n)$ and $SO(2n + 1)$. arXiv:1302.7213 Submitted.
- [42] F. Punzo and G. Terrone. On a fractional sublinear elliptic equation with a variable coefficient. arXiv:1304.4843 Submitted.

9 Partnership and outreach

Participation in the the Gulbenkian Foundation Programme Novos Talentos da Matemática

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

Participation in the Winter School for Undergraduates

Escola de Inverno de Matemática (EIM12), IST, February 4–6, 2013.

<http://math.tecnico.ulisboa.pt/teaching/eim/2013/>

Participation in the IST Summer School Mathematics, Statistics and Computing

Escola de Verão de Matemática, Estatística e Computação (EVMEC2013), IST, July 22–24, 2013.

<http://math.tecnico.ulisboa.pt/teaching/evm/2013>

Outreach activities by individual members

- Miguel Abreu coordinates the SPM project *5 minutos de Matemática*, financed by Compete and Ciência Viva, which is behind the TV show *Isto é Matemática* that airs on SIC-Notícias.
- Miguel Abreu, *Introdução às Geometrias Não-Euclidianas* (Introduction to Non-Euclidean Geometries), Maria Amália High School, Lisbon, March 13, 2013.
- Miguel Abreu, *Aprender Matemática: porquê e para quê?* (Learning Mathematics: why and what for?), Plenary Panel at the meeting Prof-Mat, Albufeira, March 23, 2013.
- Cristina Câmara participated in the 3rd edition of *Caminhos da Ciência, Tecnologia e Sociedade* (Roads of Science, Technology, and Society), IST, Universidade Técnica de Lisboa, April 9, 2013.
- L. Filipe Costa taught a *Course on Relativity* at the 9th Physics Summer School, Universidade do Porto, September 1-6, 2013.
- Fernando P. da Costa gave a speech on *Porque é que a cauda do leopardo tem riscas?* (Why does the leopard's tail have stripes?) at the First Days of Statistics and Computation of the Universidade Aberta, Caldas da Rainha, May 2013.

- Fernando P. da Costa spoke on *Em torno do algoritmo de Euclides* (On Euclid's algorithm) at Padre António Vieira High School, Lisbon, November 30, 2013.
- Fernando P. da Costa was interviewed for the magazine *MaisEducativa*. The interview entitled *A Matemática não é chata!* (Math is not boring!) was published in October 2013.
- Fernando P. da Costa organized a joint session with Rui Malhó (FCUL) on *Dinâmica de fluídos – A origem da vida* (Fluid Dynamics – The origin of life), as part of the World Café *Mathematics in Earth Adventure* at the Museu Nacional de História Natural e da Ciência, Universidade de Lisboa, June 2013.
- Fernando P. da Costa and João Teixeira Pinto were co-organizers of a Portuguese Mathematical Society (SPM) Summer School *Mathematics of Planet Earth*, Universidade de Lisboa, September 2013.
- Jorge Drumond Silva, *Ondas e Dispersão* (Waves and Dispersion), Oficinal Diagonal do Programa Novos Talentos da Matemática, Instituto Superior de Economia e Gestão (ISEG), Lisbon, February 23, 2013.
- Jorge Drumond Silva, *A Matemática da Física* (The Mathematics of Physics), À Descoberta das Rotas Matemáticas da UTL (UTL Mathematical Routes), ISEG, Lisbon, February 26, 2013.
- Jorge Drumond Silva, *Ondas e Dispersão* (Waves and Dispersion), St. Aubyn Lecture, Fall Days of MAEG (Mathematics Applied to Economics and Management), ISEG, Lisbon, December 3, 2013.
- Marco Mackaay participated in the organization of the Regional Math Olympiads and sub-12 e sub-14 Math Competitions *Matemática 5Estrelas* in the Algarve.
- Roger Picken, *Máquina de calcular com duas cordas* (A calculator from two ropes), À Descoberta das Rotas Matemáticas da UTL (UTL Mathematical Routes), IST, Lisbon, February 25 and March 4, 2013.
- Roger Picken, *Caminhos da Ciência da UTL* (UTL Scientific Paths), IST, Lisbon, April 9, 2013.
- João Pimentel Nunes, *A Matemática e o Universo* (The Mathematics and the Universe), À Descoberta das Rotas Matemáticas da UTL, ISEG, Lisbon, February 26, 2013.
- Juha Videman, mini course *O Efeito da Rotação da Terra na Circulação Atmosférica e Oceânica* (The Effect of Earth's Rotation on the

Atmospheric and Oceanic Circulation), SPM Summer School *Mathematics of Planet Earth*, Universidade de Lisboa, September 2013.

10 Personal notes

- Miguel Abreu is President of the Portuguese Mathematical Society (Sociedade Portuguesa de Matemática).
- Sílvia Anjos is Treasurer of the Portuguese Mathematical Society.
- Marco Morandotti is a member of SIAM (Society for Industrial and Applied Mathematics, USA), SIAG/MS (SIAM Activity Group on Material Science, USA) and INdAM/GNAMPA (Gruppo Nazionale per l'Analisi Matematica, la Probabilità e le loro Applicazioni, group of the Istituto Nazionale di Alta Matematica, Italy).
- Roger Picken was a member of the Scientific Committee of the XXII International Fall Workshop on Geometry and Physics, Évora, Portugal, September 2 - 5, 2013.
- Carlos Rocha was a member of the Executive Committee of the First International Conference on Dynamics of Differential Equations, in honor of Jack K. Hale, organized in Georgia Tech, Atlanta, 2013.
- Carlos Rocha was a member of the Scientific Committee of the ICMC Summer Meeting on Differential Equations, in commemoration of the 70th birthday of Hildebrando Rodrigues, organized in São Carlos, Universidade de São Paulo, 2013.
- Juha Videman was a member of the Scientific Committee of the MARINE 2013 – Fifth International ECCOMAS Conference on Computational Methods in Marine Engineering, Hamburg, Germany, May 29–31, 2013.
- Juha Videman is co-director of the CoLab Program UT Austin – Portugal in Mathematics.