Instituto Superior Técnico

Center for Mathematical Analysis,
Geometry, and Dynamical Systems

# Report 2019

April 2020

# Contents

# 1 Research Projects and Special Grants

The following research projects were coordinated by CAMGSD members in 2019:

### Categorification, quantization and knots

(Started: January 1, 2017, duration: 60 months)

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

*Reference:* Exploratory research project associated to the "FCT Investigator" Program, Ref. IF/00998/2015

*Researcher:* Marko Stošić

The principal goal of this research project is to study the concepts of categorification and quantization, in particular in the context of quantum polynomial link invariants. The main line of this interdisciplinary proposal comes from surprising and exciting connections between the knot theory and homological knot invariants on the mathematical side, and quantum field theory and string theory on the physics side, with outcomes in other fields, like number theory or spectral curves.

### CMU Portugal Program

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

The Center for Mathematical Analysis, Geometry, and Dynamical Systems has been participating in this partnership between Portuguese institutions and the Carnegie Mellon University since the program was launched in 2006. The program offers PhD Scholarships in Applied Mathematics and supports a Visiting Faculty and Researchers Program.

### Dispersive Evolution Equations

(Started: March 1, 2016, duration: 2+1 years)

*Funding agencies:* FCT-Portugal and CAPES-Brazil (Coordenação de Aperfeiçoamento de Pessoal de Nível Superior)

*Coordinator at IST:* Jorge Drumond Silva

*Number of participants:* 10

The project is concerned with wave propagation in dispersive media. The aim is to investigate dispersive models arising, e.g., in Fluid Mechanics and Plasma Physics, and study their properties such as local and global well-posedness, stability of solutions and finite time singularities.

## Geometrical and Algebraic Structures on the Space of Quantum Theories

(Started: October 1, 2018, duration: 3 years)

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

*Reference:* FCT 02/SAICT/2017/28784

*Principal investigator:* Ricardo Schiappa

*Number of participants:* 6

This project addresses mathematical structures in the space of all possible quantum theories. The space of all QFTs is infinite-dimensional, with CFT fixed-points linked by paths corresponding to RG flows. These CFTs are the building blocks of all possible quantum theories (including theories of quantum gravity and black holes). Our goal is to understand the space of all theories by first understanding some special subsets. We use complementary approaches, such as Resurgent Analysis, Bootstrap Techniques, and Localisation. These approaches solve quantum theories described by random matrix models, CFTs in diverse dimensions, and quantum theories with localisable observables. The very same theory may be approachable using these different techniques, leading to complementary information. By solving different special sets of quantum theories, we expect to describe geometrical and algebraic structures on local patches of the full space of quantum theories.

## Global Properties of Solutions of the Einstein Equations

(Started: January 1, 2016, duration: 36+6 months)

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

*Reference:* PTDC/MAT-ANA/1275/2014

*Principal investigator:* João L. Costa

*Local Coordinator at IST:* Jorge Drumond Silva

*Number of participants:* 13

The main goal of the project is the study of global properties of solutions of the Einstein equations, especially in what concerns cosmic censorship and the formation of singularities in general relativity. This requires the use of techniques of geometry and analysis, particularly hyperbolic partial differential equations.

## Higher Structures and Applications

(Started: July 1, 2018, duration: 3 years)

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

*Reference:* PTDC/MAT-PUR/31089/2017

*Principal investigator:* Roger Picken

*Number of CAMGSD participants:* 8

This project uses higher algebraic structures to obtain new results in topology, geometry and algebra, and to develop applications in related areas of physics and in topological quantum computation.

## Hydrodynamic Limits and Equilibrium Fluctuations: universality from stochastic systems

(Started: December 1, 2016, duration: 5 years)

*Funding agency:* European Research Council - Starting Grant

*Contract number:* 715734

*Principal investigator:* Patricia Gonçalves

*Number of participants:* 8

The research project aims at characterizing the universality of the macroscopic behavior of some physical systems from underlying microscopic stochastic dynamics, by deriving the macroscopic laws, namely, (stochastic) partial differential equations, which govern the space-time evolution of the thermodynamic quantities of those physical systems.

## Modeling and Analysis of Coastal Hydrodynamics and Erosion

(Started: November 1, 2018, duration: 12 + 12 months)

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

*Reference:* UTAP-EXPL/MAT/0017/2017

*Principal investigator:* Juha Videman

*Number of CAMGSD participants:* 3

Coastal ocean regions around the world are threatened by a variety of factors and the increasing risk and associated impacts have catalysed efforts to increase our understanding of the coastal ocean environment and our ability to make quantitative predictions of coastal hydrodynamics. In this project, we propose to build a numerical code based on hybridised discontinuous finite element methods for studying coastal hydrodynamics and sediment erosion with specific emphasis on regions of the Texas-U.S. and Portuguese coasts. Our goal is to develop, analyse and implement high-order finite element methods on unstructured meshes which include appropriate wave physics at various wave-lengths and wave numbers. This allows for capturing multi-scale wave physics from deep ocean basins to the continental shelf to complex coastal systems including barrier islands, inlet, bays, and estuaries.

### Quantization and Kahler Geometry

(Started: April 1, 2016, duration: 36+6 months)

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

*Reference:* PTDC/MAT-GEO/3319/2014

*Principal investigator:* João Pimentel Nunes

*Number of participants:* 7

The project studies the relations between Kahler geometry and geometric quantization. The focus is on degenerating families of Kahler metrics, in the space of Kahler metrics for a fixed cohomology class equipped with the Mabuchi metric, and relations to both Kahler and real polarizations in quantization.

### Quantum fields and knot homologies

(Started: December 1, 2013, duration 72 months)

*Funding agency:* European Research Council

*Reference:* ERC Starting Grant ID:335739

*Principal Investigator:* Piotr Sułkowski (Warsaw University, Poland)

*Local Coordinator at IST:* Marko Stošić

*Number of CAMGSD participants:* 2

This project is concerned with fundamental problems arising at the interface of quantum field theory, string theory, knot theory, and the theory of random matrices. The main aim of the project is to understand two of the most profound phenomena in physics and mathematics, namely quantization and categorification, and to establish an explicit and rigorous framework where they come into play in an interrelated fashion. The project and its aims focus on the following areas: knot homologies, super-A-polynomials, 3-dimensional supersymmetric gauge theories, topological recursion and quantization. All these research areas are connected via remarkable dualities unraveled very recently by physicists and mathematicians. The project is interdisciplinary and aims to reach the above goals by taking advantage of these dualities, in collaboration with renowned experts in each of those fields.

### Quantum Structure of Spacetime

(Started: April 30, 2015, duration 48 months)

*Funding agency:* EU

*Reference:* COST Action MP1405

*Member of the Management Committee:* José Mourão

*Substitute Member of the Management Committee:* Roger Picken

*Number of CAMGSD participants:* 7

Noncommutative geometry (NCG) is at the heart of quantum physics, and its many facets and developments have widely influenced both physics and mathematics. This Action aims to create a Network with world experts from across Europe in the interconnected research subjects of NCG and gravity. As data emerges from Cosmic Microwave Background and quantum interferometry experiments, a prime objective of the Action will be to seek measurable signatures of quantum spacetime.

### Recursive and Exact New Quantum Theory

(Started: November 1, 2019, duration: 6 years)

*Funding agency:* European Research Council

*Reference:* ERC Synergy Grant 810573/2019

*Principal Investigators:* Jørgen Andersen (DIAS), Bertrand Eynard (CEA-Saclay), Maxim Kontsevich (IHES), Marcos Mariño (UniGe)

*Local Coordinator at IST:* Ricardo Schiappa (member of "Marcos Mariño Research-Team")

*Number of CAMGSD participants:* 1

Based on advanced geometric and topological constructions the ReNewQuantum teams will build a new approach to Quantum Theory - providing explicit recursive schemes which compute effectively quantum corrections to all orders and obtaining exact results using all non-perturbative contributions.

### Riemannian and Kähler Geometry on Toric Manifolds

(Started: May 1, 2016, duration: 3 years)

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

*Reference:* PTDC/MAT-GEO/1608/2014.

*Principal investigator:* Rosa Sena-Dias

*Number of CAMGSD participants:* 2

Toric Manifolds are particular Kähler Manifolds but have extremely rich geometric behavior. This project's motto is to use Toric Manifolds as testing ground for two of the main questions in Geometry, namely: is a Riemannian Manifold determined by its spectrum? And, what is the best metric on a Manifold?

### Symplectic Geometry and Conservative Dynamics

(Started: October 1, 2018, duration: 36 months)

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

*Reference:* PTDC/MAT-PUR/29447/2017

*Principal investigator:* Miguel Abreu

*Number of CAMGSD participants:* 5

This project brings together experts in different aspects of the area of Symplectic Geometry and its applications, and aims at building bridges between different techniques, creating novel enhancements and stimulating new developments in the field. The area of application of Symplectic Geometry that better represents the unifying theme of this project is Conservative Dynamics, considered in a broader context, focusing on its links with symplectic and contact topology, toric actions, Seidel's morphism and Gromov-Witten theory, Poisson geometry and integrable systems.

## 2 Visitors

The following researchers visited the Center in 2019:

**January**

Ouasy Doungsavanh, National University of Laos

Gnord Maypaokha, National University of Laos

Khankham Vongsavang, National University of Laos

Ismar Volic, Wellesley College, USA

Hugues Auvray, Université Paris-Sud

**February**

San Vũ Ngoc, IRMAR, Université de Rennes 1

Bruno Oliveira, University of Miami

Alessia Mandini, PUC, Rio de Janeiro

Oguzhan Kaya, Galatasaray University, Istanbul

Roberto Paoletti, Università di Milano Bicocca

Federico Sau, Delft University

Noa Zilberman, Technion - Israel Institute of Technology

Juan Antonio Valiente Kroon, Queen Mary, University of London

**March**

Christopher Martin Edwards. Queen's College, University of Oxford

Paulo Lima Filho, Texas A&M University

Christopher Deninger, Universität Münster

Rachid El Harti, Université Hassan I, Morocco

Nicola Vassena, Freie Universität Berlin

Ofer Busani, University of Bristol

Lars Setktnan, UQUAM Montréal

Claude LeBrun, Stony Brook University, USA

Adela Mihai, Technical University of Civil Engineering Bucharest

Jarrod Williams, Queen Mary, University of London

**April**

Thomas Mohaupt, University of Liverpool

Gleb Smirnov, ETH Zürich

João Fontinha, ETH Zürich

Clement Erignoux, Universitá Roma Tre

Davide Masoero, Faculdade de Ciências, Universidade de Lisboa

**May**

Mark Lawson, Heriot-Watt University

Romain Horcada, ENSTA-Paris

Conrado Costa, Leiden University

Cédric Bernardin, Université Nice Sophia-Antipolis

Diogo Arsénio, New York University at Abu Dhabi

Simão Correia, Faculdade de Ciências, Universidade de Lisboa

Isabelle Charton, Universität zu Köln

Ceyda Simsek, University of Groningen

Nils Carqueville, Universität Wien

Vishnu Jejjala, University of the Witwatersrand

Federico Cantero, Universitá di Barcelona

**June**

Thomas Fuehrer, Pontificia Universidad Católica de Chile

Brian Hall, University of Notre Dame

Ari Laptev, Imperial College London

Rui Loja Fernandes, University of Illinois at Urbana-Champaign

David Sauzin, CNRS, Paris

Frédéric Fauvet, University of Strasbourg

Bernold Fiedler, Freie Universität Berlin

Alejandra Maestripieri, Instituto Argentino de Matemática Alberto P. Calderón

Rodrigo Fontana, Universidade Federal da Fronteira do Sul

Pietro Caputo, Universitá Roma Tre

Hugo Tavares, Faculdade de Ciências, Universidade de Lisboa

Joe Chen, Colgate University, USA

Richard Laugesen, University of Illinois at Urbana-Champaign

Jo Nelson, Rice University

Stefano Andriolo, Hong Kong University of Science and Technology

**July**

Giuseppe Buttazzo, Universitá di Pisa

Hansjörg Geiges, Universität zu Köln

Gonçalo Oliveira, Universidade Federal Fluminense

Frédéric Bourgeois, Université Paris Sud

Raul Curto, University of Iowa

Martin Evans, Edinburgh University

Rui Loja Fernandes, University of Illinois at Urbana-Champaign

**September**

Roksana Słowik, Silesian University of Technology, Poland

Izak Moerdijk, Utrecht University

Marcel de Jeu, Leiden University

Yafet Sanchez Sanchez, Leibniz University, Hannover

Debashis Ghoshal, Jawaharlal Nehru University

**October**

Gonçalo Oliveira, Universidade Federal Fluminense

Jorge António, Université Paul Sabatier (Toulouse III)

António Girão, University of Birmingham

Gunter Schutz, Forschungszentrum Jülich

Tertuliano Franco, Universidade Federal da Bahia

Ugo Bruzzo, SISSA, Italy and Universidade Federal da Paraíba

Amol Sasane, London School of Economics

Tomás Reis, Université de Genève

Michele Cirafici, Universitá di Trieste

**November**

Alex Bullivant, University of Leeds

Bruno Colbois, Université de Neuchâtel

Michela Zedda, Università di Parma

Kumbakonan Rajagopal, Texas A&M University

Jaume Llibre, Universitat Autónoma de Barcelona

Angelo Carollo, University of Palermo

Johannes Kleiner, Institute for Theoretical Physics, Leibniz University, Hanover

Francesca Ferrari, SISSA, Trieste

Aleksandar Mikovic, Universidade Lusófona

Ángel Gonzáez-Prieto, ICMAT, Madrid

Tom Sutherland, Faculdade de Ciências, Universidade de Lisboa

**December**

Paul Wedrich, Max Planck Institute and Universität Bonn

Anna Siffert, Max-Planck-Institut, Bonn

Rolf Stenberg, Aalto University, Finland

Ernesto Nungesser, Universidad Politécnica de Madrid

Alan Coley, Dalhousie University, Canada

André Guerra, University of Oxford

Paolo Benincasa, Niels Bohr Institute

João Caetano, Simons Center for Geometry and Physics, USA

# 3 Seminar Series and Working Seminars

## 3.1 Algebra

**Jan 16**

**Ismar Volic**. *Wellesley College.* Cohomology of braids, graph complexes, and configuration space integrals.

**Mar 18**

**Paulo Lima-Filho**. *Texas A&M University.* Equidimensional algebraic cycles and current transforms.

**Mar 20**

**Christopher Deninger**. *University of Muenster.* Dynamical systems for arithmetic schemes - the higher dimensional case.

**Mar 21**

**Rachid El Harti**. *Université Hassan I, Morocco.* Amenable algebras: algebraic and analytical perspectives.

**Apr 24**

**João Fontinha**. *ETH Zürich.* A primer on the Section Conjecture – a bridge between arithmetic and homotopy.

**May 09**

**Mark Lawson**. *Heriot-Watt University.* Non-commutative Boolean algebras.

**Sep 13**

**Marcel de Jeu**. *Leiden University and University of Pretoria.* Positive representations of algebras of continuous functions.

**Oct 23**

**Jorge António**. *Université Paul Sabatier (Toulouse III).* Derived Geometry and its applications.

**Oct 24**

**António Girão**. *University of Birmingham.* Dirac's theorem for random regular graphs.

## 3.2 Analysis, Geometry, and Dynamical Systems

**Feb 12**

**Federico Sau**. *Delft University.* Self-duality for conservative interacting particle systems.

**Mar 19**

**Nicola Vassena**. *Freie Universität Berlin.* Introduction to sensitivity of chemical reaction networks.

**Mar 26**

**Ofer Busani**. *University of Bristol.* Transversal fluctuations in last passage percolation.

**Apr 02**

**Clement Erignoux**. *Universitá Roma Tre.* Hydrodynamics for a non-ergodic facilitated exclusion process.

**Apr 16**

**Phillipo Lappicy**. *ICMC, Universidade de São Paulo and CAMGSD, Instituto Superior Técnico.* A nonautonomous Chafee-Infante attractor: a connection matrix approach.

**May 14**

**Conrado Costa**. *Leiden University.* Random walks in cooling random environments: stable and unstable behaviors under regular diverging cooling maps.

**May 21**

**Cédric Bernardin**. *Université Nice Sophia-Antipolis.* Microscopic models for multicomponents SPDE's with a KPZ flavor.

**May 28**

**Diogo Arsénio**. *New York University at Abu Dhabi.* Recent progress on the mathematical theory of plasmas.

**May 30**

**Simão Correia**. *Faculdade de Ciências, Universidade de Lisboa.* Critical well-posedness for the modified Korteweg-de Vries equation and self-similar dynamics.

**Jun 04**

**Brian Hall**. *University of Notre Dame.* Large-$N$ Segal-Bargmann transform with application to random matrices.

**Jun 17**

**Pietro Caputo**. *Universitá Roma Tre.* Mixing time of the adjacent walk on the simplex.

**Jun 18**

**Pietro Caputo**. *Universitá Roma Tre.* The spectral gap of the interchange process: a review.

**Jun 27**

**Renato De Paula**. *CAMGSD, Instituto Superior Técnico.* Matrix product ansatz for the totally asymmetric exclusion process.

**Jun 27**

**Hugo Tavares**. *Faculdade de Ciências, Universidade de Lisboa.* Least energy solutions of Hamiltonian elliptic systems with Neumann boundary conditions.

**Jun 28**

**Gabriel Nahum**. *CAMGSD, Instituto Superior Técnico.* On the algebraic solvability of the MPA approach to the Multispecies SSEP.

**Jun 28**

**Joe Chen**. *Colgate University.* Random walks, electric networks, moving particle lemma, and hydrodynamic limits.

**Jul 01**

**Martin Evans**. *Edinburgh University.* Open Boundary ASEP.

**Jul 02**

**Martin Evans**. *Edinburgh University.* Matrix Product Solution.

**Jul 03**

**Martin Evans**. *Edinburgh University.* Phase Diagram.

**Jul 04**

**Martin Evans**. *Edinburgh University.* Generalisations to Multispecies.

**Jul 05**

**Martin Evans**. *Edinburgh University.* Generalisations to Multispecies.

**Oct 01**

**Gunter Schutz**. *Forschungszentrum Jülich.* The Fibonacci family of dynamical universality classes.

**Oct 21**

**Tertuliano Franco**. *Universidade Federal da Bahia.* A Mini-course in large deviations.

**Oct 23**

**Tertuliano Franco**. *Universidade Federal da Bahia.* A Mini-course in large deviations.

**Oct 25**

**Tertuliano Franco**. *Universidade Federal da Bahia.* A Mini-course in large deviations.

**Oct 29**

**Alessandra Occelli**. *CAMGSD, Instituto Superior Técnico.* A short KPZ story.

**Nov 05**

**Alessandra Occelli**. *CAMGSD, Instituto Superior Técnico.* KPZ universality for last passage percolation models.

**Nov 14**

**Stefano Scotta**. *CAMGSD, Instituto Superior Técnico.* Equilibrium fluctuations for symmetric exclusion with long jumps and infinitely extended reservoirs.

**Dec 17**

**Renato de Paula**. *CAMGSD, Instituto Superior Técnico.* From the porous medium model to the porous medium equation.

### 3.3 Geometria em Lisboa

**Jan 07**

**Hugues Auvray**. *Université Paris-Sud.* Complete extremal metrics and stability of pairs on Hirzebruch surfaces.

**Feb 26**

**Bruno Oliveira**. *University of Miami.* Big jet-bundles on resolution of orbifold surfaces of general type.

**Mar 07**

**Lars Setktnan**. *UQUAM Montréal.* Blowing up extremal Poincaré type manifolds.

**Mar 12**

**Claude LeBrun**. *Stonybrook.* Einstein Metrics, Harmonic Forms, and Conformally Kaehler Geometry.

**Mar 14**

**Adela Mihai**. *Technical University of Civil Engineering Bucharest.* On Einstein spaces.

**Apr 11**

**Gleb Smirnov**. *ETH Zurich.* Symplectic triangle inequality.

**May 09**

**Isabelle Charton**. *University of Cologne.* Hamiltonian $S^1$-spaces with large equivariant pseudo-index.

**Jun 03**

**Richard Laugesen**. *University of Illinois at Urbana-Champaign.* Spectrum of the Robin Laplacian: recent results, and open problems.

**Jun 21**

**Jo Nelson**. *Rice University.* Equivariant and nonequivariant contact homology.

**Jul 17**

**Frédéric Bourgeois**. *Université Paris Sud.* Geography of (bi)linearized Legendrian contact homology.

**Jul 17**

**Hansjörg Geiges**. *Universität zu Köln.* Constructions of contact manifolds with controlled Reeb dynamics.

**Jul 19**

**Rui Loja Fernandes**. *University of Illinois at Urbana-Champaign.* Stability of symplectic leaves.

**Oct 01**

**Ugo Bruzzo**. *SISSA, Trieste & Universidade Federal da Paraíba* On a conjecture about curve semistable Higgs bundles.

**Nov 06**

**Emilio Franco**. *CAMGSD, Instituto Superior Técnico.* Introduction to Mirror Symmetry on the Hitchin System.

**Nov 12**

**Michela Zedda**. *Universitá di Parma.* Projectively induced Ricci-flat Kaehler metrics.

**Nov 19**

**Bruno Colbois**. *Université de Neuchâtel.* On the shape of a Riemannian manifold with large first nonzero eigenvalue for the Laplacian and the Dirichlet-to-Neumann operator.

**Dec 03**

**Anna Siffert**. *Max-Planck-Institut, Bonn.* Construction of harmonic mappings.

## 3.4 Mathematical Relativity

**Jan 30**

**Anne Franzen**. *CAMGSD, Instituto Superior Técnico.* Flat FLRW and Kasner Big Bang singularities analyzed on the level of scalar waves.

**Feb 07**

**Noa Zilberman**. *Technion - Israel Institute of Technology.* Quantum effects near the inner horizon of a black hole.

**Feb 13**

**Juan Antonio Valiente Kroon**. *Queen Mary, University of London.* Construction of anti de Sitter-like spacetimes using the metric conformal field equations.

**Feb 22**

**Pedro Girão**. *CAMGSD, Instituto Superior Técnico.* Solutions of the wave equation bounded at the Big Bang.

**Feb 27**

**Artur Alho**. *CAMGSD, Instituto Superior Técnico.* Multi-body spherically symmetric steady states of Newtonian self-gravitating elastic matter.

**Mar 08**

**Moritz Reintjes**. *CAMGSD, Instituto Superior Técnico.* Introduction to the Theory of Shock Waves.

**Mar 14**

**Jarrod Williams**. *Queen Mary, University of London.* The Friedrich-Butscher method for the construction of initial data in General Relativity.

**Mar 20**

**José Natário**. *CAMGSD, Instituto Superior Técnico.* Elastic shocks in relativistic rigid rods and balls.

**May 15**

**Carlos Herdeiro**. *Instituto Superior Técnico.* Light ring stability in ultra-compact objects.

**May 22**

**Phillipo Lappicy**. *Universidade de São Paulo.* Space of initial data for self-similar Schwarzschild solutions.

**Jun 27**

**Rodrigo Fontana**. *Universidade Federal da Fronteira do Sul - UFFS Chapecó.* Quasinormal modes of black holes: field propagation and stability.

**Sep 20**

**Yafet Sanchez Sanchez**. *Leibniz University, Hannover.* Quantum Observables in low regularity spacetimes.

**Oct 21**

**Amol Sasane**. *London School of Economics.* Decay of solutions to the Klein-Gordon equation on some expanding cosmological spacetimes.

**Nov 08**

**Gabriel Lopes Cardoso**. *CAMGSD, Instituto Superior Técnico.* Weyl metrics and Wiener-Hopf factorization.

**Dec 06**

**Ernesto Nungesser**. *Universidad Politécnica de Madrid.* On the massless Einstein-Boltzmann system.

**Dec 16**

**Alan Coley**. *Dalhousie University.* Theoretical cosmology.

### 3.5 Partial Differential Equations

**Jun 26**

**Thomas Fuehrer**. *Pontificia Universidad Católica de Chile.* Introduction to the DPG method: Abstract framework and applications.

**Dec 17**

**André Guerra**. *University of Oxford.* Compensated compactness and under constant rank constraints.

### 3.6 $QM^3$ Quantum Matter meets Maths

**Oct 18**

**Tomás Reis**. *University of Geneva.* Resurgence, Superconductors and Renormalons.

**Oct 31**

**Bruno Mera**. *Security and Quantum Information Group of Instituto de Telecomunicações.* The geometry and topology of free fermions.

**Nov 15**

**Angelo Carollo**. *University of Palermo.* On quantumness in multiparameter quantum critical metrology.

**Nov 29**

**Alex Bullivant**. *University of Leeds.* Topological Quantum Computing with loops.

### 3.7 String Theory

**Apr 01**

**Davide Masoero**. *Faculdade de Ciências, Universidade de Lisboa.* Meromorphic opers and the Bethe Ansatz.

**May 06**

**Ceyda Simsek**. *University of Groningen.* Spacetime geometry of non-relativistic string theory.

**May 07**

**Nils Carqueville**. *University of Vienna.* TQFTS, Orbifolds and Topological Quantum Computation.

**May 20**

**Vishnu Jejjala**. *University of the Witwatersrand.* Experiments with Machine Learning in Geometry & Physics.

**Jun 24**

**Stefano Andriolo**. *Hong Kong University of Science and Technology.* The Weak Gravity Conjecture.

**Sep 27**

**Debashis Ghoshal**. *Jawaharlal Nehru University.* Designing matrix models for zeta functions.

**Oct 22**

**Michele Cirafici**. *University of Trieste.* Supersymmetric line operators and their spectral problem.

**Nov 18**

**Francesca Ferrari**. *SISSA Trieste.* A look into $3d$ modularity.

**Dec 09**

**Paolo Benincasa**. *Niels Bohr Institute.* Understanding $AdS_2$: From Calogero-like models and SLE to $4d$ black hole microstate entropy.

**Dec 16**

**João Caetano**. *Simons Center for Geometry and Physics.* Integrability in and beyond AdS/CFT.

### 3.8 Topological Quantum Field Theory

**Jan 10**

**Marco Mackaay**. *Universidade do Algarve.* The 2-representation theory of Soergel bimodules of finite Coxeter type: a road map to the complete classification of all simple transitive 2-representations.

**Feb 27**

**Gonçalo Quinta & Rui André**. *Physics of Information and Quantum Technologies Group - IST (GQ); Center for Astrophysics and Gravitation - IST (RA).* Topological Links and Quantum Entanglement.

**May 07**

**Federico Cantero**. *University of Barcelona* Higher Steenrod squares for Khovanov homology.

**Jun 05**

**Brian Hall**. *University of Notre Dame.* Eigenvalues of random matrices in the general linear group.

**Oct 09**

**Roger Picken**. *CAMGSD, Instituto Superior Técnico.* Quantum theory via (higher) groupoids and quantum measures.

**Oct 23**

**Manuel Araújo**. *CAMGSD, Instituto Superior Técnico.* Topological Field Theory in dimension 3.

**Nov 05**

**Roger Picken**. *CAMGSD, Instituto Superior Técnico.* Research topics in higher gauge theory, knot theory, and anyons.

**Nov 05**

**João Esteves**. *CAMGSD, Instituto Superior Técnico.* A quantization of the Loday-Ronco Hopf algebra.

**Nov 05**

**Pedro Lopes**. *CAMGSD, Instituto Superior Técnico.* Research topics in persistent tangles and hyperfinite knots.

**Nov 05**

**Marko Stosic**. *CAMGSD, Instituto Superior Técnico.* On Colored HOMFLY homology.

**Nov 06**

**Marco Mackaay**. *CAMGSD, Universidade do Algarve.* 2-Representation theory.

**Nov 06**

**John Huerta**. *CAMGSD, Instituto Superior Técnico.* Higher structures on supermanifolds.

**Nov 06**

**Manuel Araújo**. *CAMGSD, Instituto Superior Técnico.* Coherence for 3-dualizable objects.

**Nov 06**

**Aleksandar Mikovic**. *Universidade Lusófona.* Categorification of LQG spin-network basis.

**Nov 06**

**Pedro Brito**. *CAMGSD, Instituto Superior Técnico.* Galois symmetries in geometry.

**Nov 27**

**Ángel Gonzáez-Prieto**. *ICMAT, Madrid.* Topological recursion in the motivic theory of character varieties.

**Nov 27**

**Alex Bullivant**. *University of Leeds.* $3+1D$ Dijkgraaf-Witten theory and the Categorified Quantum Double.

**Dec 11**

**Paul Wedrich**. *Max Planck Institute and University of Bonn.* Invariants of 4-manifolds from Khovanov-Rozansky link homology.

### 3.9 Working Seminar on mirror symmetry on the Hitchin system

**Nov 06**

**Emilio Franco**. *CAMGSD, Instituto Superior Técnico.* Introduction to Mirror Symmetry on the Hitchin System.

**Nov 13**

**Tom Sutherland**. *Faculdade de Ciências, Universidade de Lisboa.* The derived category of coherent sheaves.

**Nov 20**

**Emilio Franco**. *CAMGSD, Instituto Superior Técnico.* The derived category of coherent sheaves II.

## 4 Conferences and short courses

The following Conferences and Short Courses were organized or co-organized by members of the Center in 2019:

### 8th IST Lectures on Algebraic Geometry and Physics – 2019

*Instituto Superior Técnico, Lisbon, Portugal, February 18–20, 2019*

*Organizing committee:* José Mourão (CAMGSD), João Pimentel Nunes (CAMGSD)

*Short courses:*

**Roberto Paoletti**. *University of Milano-Bicocca.* Szegö kernels in geometric quantization: an introductory overview

**San Vũ Ngọc**. *IRMAR, Université de Rennes 1.* Microlocal analysis, quantization and integrable systems

### 1st Colloquium on Interacting Particle Systems at IST

*Instituto Superior Técnico, Lisbon, Portugal, March 15, 2019*

*Organizer:* Patrícia Gonçalves (CAMGSD)

### Fifth Minho Meeting on Mathematical Physics

*Universidade do Minho, Guimarães, March 29, 2019*

*Organizer:* Irene Brito (CMAT), M. Piedade Ramos (CMAT), Filipe Mena (CAMGSD)

### WOT 19 – Women in Operator Theory and its Applications

*Instituto Superior Técnico, Lisbon, Portugal, June 17–19, 2019*

*Organizers:* Fernanda Botelho (University of Memphis, USA), Cristina Câmara (CAMGSD), Cristina Diogo (CAMGSD), Dijana Ilisevic (University of Zagreb, Croatia).

### Geometrical and Algebraic Structures on the Space of Quantum Theories

*Instituto Superior Técnico, Lisbon, Portugal, September 5-6, 2019*

*Organizers:* Ricardo Schiappa (CAMGSD), João Pimentel Nunes (CAMGSD).

### Higher Structures and Applications mini-meeting

*Instituto Superior Técnico, Lisbon, Portugal, November 5–6, 2019*

*Organizers:* Roger Picken (CAMGSD)

### Particle Systems and PDE's VIII

*Instituto Superior Técnico, Lisbon, Portugal, December 2–6, 2019*

*Organizers:* Cédric Bernardin (University of Nice), Conceição Carvalho (CMAF-CIO, University of Lisbon), Patrícia Gonçalves (CAMGSD), Ana Jacinta Soares (CMAT, University of Minho)

### XII Black Hole Workshop, Scientific and Local Organizing Committees

*Universidade do Minho, Guimarães, December 19-20, 2019*

*Organizers:* V. Bessa (CAMGSD), I. Brito (CMAT), A. García-Parrado (Praga), P. Luz (CAMGSD), F. Mena (CAMGSD), F. Moura (ISCTE), J. Oliveira (CAMGSD), M. P. Ramos (CMAT)

# 5 Seminars given by members of the Center

The following seminar talks, invited lectures or short courses were given by members of the Center in 2019:

Miguel Abreu, Contact invariants of Gorenstein toric contact manifolds, the Ehrhart polynomial and Chen-Ruan cohomology, Workshop on Conservative Dynamics and Symplectic Geometry, IMPA, Rio de Janeiro, Brazil, August 5-9, 2019.

Artur Alho, Spherically symmetric steady states of Newtonian self-gravitating elastic matter, 22nd International Conference on General Relativity and Gravitation, Valencia, Spain, July 9, 2019.

Artur Alho, Dynamical systems in perturbative cosmology, 22nd International Conference on General Relativity and Gravitation, Valencia, Spain, July 10, 2019.

Artur Alho, Spherically symmetric steady states of Newtonian self-gravitating elastic matter, Junior Analysis Seminar, Imperial College London, UK, November 15, 2019.

Artur Alho, Spherically symmetric steady states of Newtonian self-gravitating elastic matter, Vienna Relativity Seminar, University of Vienna, Austria, November 28, 2019.

João Alves, On the space of generating functions of an infinite order linear recurrence, International Conference Progress on Difference Equations (PODE 2019), Bragança, Portugal, May 27-30, 2019.

Pedro Boavida de Brito, Galois symmetries on knot spaces, Topology seminar, EPFL Lausanne, Switzerland, November 11, 2019.

Pedro Boavida de Brito, Configuration spaces on a triangulated manifold, Geometry seminar, Utrecht University, The Netherlands, April 12, 2019.

Pedro Boavida de Brito, Galois symmetries on knot spaces, Geometry and Topology seminar, Universidade do Porto, Portugal, March 8, 2019.

Farid Bozorgnia, Optimal shape of the p-Laplacian eigenvalue, Workshop 1, Linz, Austria, October 17, 2019.

Farid Bozorgnia, Existence, uniqueness and numerical investigation of segregation models, VIII PDEs, optimal design and numerics, Benasque, Spain, August 23, 2019.

Farid Bozorgnia, Eigenvalues of p-Laplace and Infinity Laplace operator, International Workshop on Nonlocal Models, PDEs and Applications, Caen, Normandy, France, May 14, 2019.

Farid Bozorgnia, On a Class of Singularly Perturbed Elliptic Systems with Asymptotic Phase Segregation, Workshop on Geometric Measure Theory and Free Boundary Problems, HIM, Boon, Germany, February 13, 2019.

Cristina Câmara, A Riemann-Hilbert approach to Einstein field equations, Factorisation of matrix functions: New techniques and applications - Isaac Newton Institute Workshop, Cambridge, UK, August 12-16, 2019.

Cristina Câmara, Dual truncated Toeplitz operators, Special Session on Operators on Reproducing Kernel Hilbert Spaces, IWOTA 2019, Lisbon, Portugal, July 22-26, 2019.

Cristina Câmara, Scalar type kernels for block Toeplitz operators, Korea Operator Theory and its Applications - KOTAC 2019, Gyeongju, Korea, June 27-29, 2019.

Cristina Câmara, Completions of partial operator matrices, Young Functional Analysts' Workshop YFAW 2019, Leeds, UK, April 3-5, 2019.

João L. Costa, Black Hole Interiors in General Relativity, Eddington at Sundy, Ilha do Príncipe, May 2019.

João L. Costa, Strong Cosmic Censorship, Linear Waves and Quasinormal Modes, Mathematical Relativity Seminar, Sorbonne University, France, February 2019.

João L. Costa, Strong Cosmic Censorship and Quasinormal Modes, Vienna Relativity Seminar, University of Vienna, Austria, January 2019.

João L. Costa, A Análise Matemática de Buracos Negros, Seminário de Matemática e Seminário de Física, ISEL, Lisboa, Portugal, May 2019.

Luís Filipe Costa, The gravitational Magnus effect, 22th International Conference on General Relativity and Gravitation (GR22), Valencia, Spain, July 7-12, 2019.

Luís Filipe Costa, Gravitomagnetism in the Lewis Cylindrical metrics, 22th International Conference on General Relativity and Gravitation (GR22), Valencia, Spain, July 7-12, 2019.

Luís Filipe Costa, Gravitomagnetism in the Lewis Cylindrical metrics, XII Black Holes Workshop, Guimarães, Portugal, December 19-20, 2019.

Fernando Pestana da Costa, Rates of convergence to similarity profiles in a deposition model. Indian Institute of Technology Roorkee, Roorkee, India, January 2019.

Fernando Pestana da Costa, Bifurcations in liquid crystals cells. Indian Institute of Technology Roorkee, Roorkee, India, January 2019.

Leonardo di Carlo, Probability theory and Renormalization Group, Ravello Summer School 2019 of Mathematical Physics, Ravello, Italy, September 7, 2019.

Leonardo di Carlo, Scaling limit of a turbolent exclusion processes", Seminar of Probability, Universitá di L'Aquila, Italy, November 27, 2019.

Leonardo di Carlo, Renormalization group and limit theorems in probability, Seminar of Probability, GSSI, L'Aquila, Italy, December 16, 2019.

Jorge Drumond Silva, Mass inflation and strong cosmic censorship for the spherically symmetric Einstein-Maxwell-scalar field system with a cosmological constant and an exponential Price law, Workshop Nonlinear PDEs in Braga, Univ. Minho, Portugal, June 8, 2019.

Jorge Drumond Silva, Mass inflation and strong cosmic censorship for the spherically symmetric Einstein-Maxwell-scalar field system with a cosmological constant and an exponential Price law, GR22 22nd International Conference on General Relativity and Gravitation, Valencia, Spain, July 9, 2019.

Chiara Franceschini, The partial exclusion process and its inclusion counterpart, 1st Colloquium on Interacting Particle System, IST, Lisboa, Portugal, March 15, 2019.

Chiara Franceschini, Duality for the simple symmetric exclusion process with slow boundaries, Second Italian Meeting on Probability and Mathematical Statistics, Vietri, Italy June 19, 2010

Chiara Franceschini, Exclusion process on the Sierpinski Gasket, 2nd Colloquium on Interacting Particle System, IST, Lisboa, Portugal, July 5, 2019.

Emilio Franco, Cartan branes on the Hitchin system, ISAAC 2019 Conference - Special Session on Complex Geometry, Aveiro, Portugal, July - August 2019.

Emilio Franco, Torsion line bundles and branes on the Hitchin system, Conference on Algebraic Analysis and Geometry with a view on Higgs bundles and D-modules, Porto, Portugal, June 2019.

Anne Franzen, Stability of black holes: and how to use scalar waves for their analysis . Spitzer Physics Seminar, California State University, East Bay, Hayward, California, USA, October 11, 2019.

Anne Franzen, Flat Friedmann-Lemaître-Robertson-Walker and Kasner Big Bang singularities analyzed on the level of scalar waves, Equadiff 2019 conference, Leiden, the Netherlands, July 11, 2019.

Anne Franzen, Flat Friedmann-Lemaître-Robertson-Walker and Kasner Big Bang singularities analyzed on the level of scalar waves, seminar, University of Vienna, Austria, June 6, 2019.

Anne Franzen, Flat Friedmann-Lemaître-Robertson-Walker and Kasner Big Bang singularities analyzed on the level of scalar waves, Quantum gravity seminar, Radboud University Nijmegen, the Netherlands, February 2, 2019.

Pedro Girão, Higher order linear stability and instability of Reissner-Nordström's Cauchy Horizon. Mathematical Relativity and Classical Gravitation Session of the 22nd International Conference on General Relativity and Gravitation and 13th Edoardo Amaldi Conference on Gravitational Waves, Valência, Spain, July 7-12, 2019

Pedro Girão, Solutions of the wave equation bounded at the Big Bang. International Workshop on Differential Equations on the occasion of Luís Sanchez's 70th birthday, Faculdade de Ciências, Universidade de Lisboa, Portugal, September 5-6, 2019.

Patricia Gonçalves, Derivation of the regional fractional Laplacian with several boundary conditions, Northeast Probability seminar NYU, USA, November 22, 2019.

Patricia Gonçalves, A random dynamics for the regional fractional Laplacian with several boundary conditions, Workshop on "Universality in interacting particle systems", University of Cologne, Germany, September 2, 2019.

Patricia Gonçalves, Deriving (fractional) PDEs from microscopic stochastic dynamics, 1st Women in Mathematics Meeting, FCT-UNL, Lisbon, Portugal, July 24, 2019.

Patricia Gonçalves, Derivation of a fractional reaction-diffusion equation from an interacting particle system, 1st Joint Meeting Brazil-France in Mathematics, IMPA, Rio de Janeiro, Brazil, July 15, 2019.

Patricia Gonçalves, Ice particles, coffee ring effects, propagation of fires and the Tetris game: what is their mathematical relationship?, seminar, IST, Lisbon, July 1, 2019.

Patricia Gonçalves, Deriving (fractional) deterministic laws from the random motion of particles, Göran Gustafsson symposium in mathematics, Stockholm, Sweden, June 14, 2019.

Patricia Gonçalves, From the random motion of particles to partial differential equations, 4th ENEMath meeting, Porto, Portugal, April 15, 2019.

Patricia Gonçalves, An introduction to Probability theory, seminar, Oficina Diagonal, FCT-UNL, Lisbon, Portugal, February 23, 2019.

Patricia Gonçalves, From randomness to determinism", Colloquium IST, Lisbon, February 14, 2019.

Patricia Gonçalves, How to obtain deterministic laws from a random motion of particles, seminar, ISEG, Lisbon, Portugal, February 13, 2019

Patricia Gonçalves, Deriving the SBE from weakly asymmetric interacting particle systems, Inhomogeneous Random Systems, IHP, Paris, France, January 23, 2019.

Patricia Gonçalves, Obtaining a fractional reaction-diffusion equation from an interacting particle system", seminar, CMAT, University of Minho, Braga, Portugal January 3, 2019.

John Huerta, Higher gauge theory on supermanifolds, Mathematical Physics Seminar, University of Lyon, France, November 8, 2019.

John Huerta, The equivariant brane bouquet, University of Malaga, Spain, May 22, 2019.

John Huerta, Division algebras and the brane bouquet, Workshop on Geometric Structures in Mathematics and Physics, University of Bologna, Italy, February 15, 2019.

John Huerta, Division algebras and supersymmetry, Workshop on Geometric Structures in Mathematics and Physics, University of Bologna, Italy, February 14, 2019.

Philippo Lappicy, Dynamics, symmetry and patterns: a tour of Einstein, Ginzburg and Landau, Seminar, University of Rwanda, Kigali, Rwanda, February 2019.

Philippo Lappicy, Dynamics, symmetry and patterns: a tour of Einstein, Ginzburg and Landau, Seminar, University of Coimbra, Portugal, April 2019.

Philippo Lappicy, Dynamics, symmetry and patterns: a tour of Einstein, Ginzburg and Landau, Seminar, Tarbiat Modares University, Tehran, Iran, May 2019.

Philippo Lappicy, Non-autonomous Chafee-Infante attractors: a connection matrix approach, Freie Universität Berlin, Germany, May 2019.

Philippo Lappicy, A Lyapunov function for fully nonlinear parabolic equations in one spatial variable, Conference on PDEs in Braga, Portugal, June 2019.

Philippo Lappicy, Quasilinear parabolic equations: from Sturm attractors to Ginzburg-Landau patterns, 12th ISAAC Congress, Aveiro, Portugal, July 2019.

Philippo Lappicy, A Poincaré compactification (and hope of continuation) of blow-up solutions of parabolic equations, Freie Universität Berlin, Germany, October 2019.

Philippo Lappicy, Horava-Lifshitz Gravity: Bifurcations and Chaos, Seminar, Weierstraß-Institut WIAS, Berlin, Germany, November 2019.

Pedro Lopes, The prevalence of persistent tangles, Seminário de Geometria, Departamento de Matemática, Universidade de Coimbra, Portugal, October 23, 2019.

Gabriel Lopes Cardoso, Exact results and BPS black hole microstate counting formulae in an N=2 STU model, AEI Golm, Germany, June 3, 2019.

Gabriel Lopes Cardoso, Exact results and microstate counting formulae for BPS black holes in the N=2 STU model, Iberian Strings 2019, Barcelona, Spain, January 23-25, 2019.

Gabriel Lopes Cardoso, BPS black holes in four dimensions, Fifth Minho Meeting on Mathematical Physics - Conference in Honour of Estelita Vaz, Guimarães, Portugal, March 29, 2019.

Marco Mackaay, The 2-theory of Soergel bimodules of finite Coxeter type: a road map to the complete classification of all simple transitive 2-representations, Seminário de Álgebra e Combinatória, Universidade de Coimbra, January 23, 2019.

Marco Mackaay, , The 2-theory of Soergel bimodules of finite Coxeter type: a road map to the complete classification of all simple transitive 2-representations, Seminário de Geometria e Topologia, Universidade do Porto, January 24, 2019.

Marco Mackaay, The 2-representation theory of Soergel bimodules, Algebra and Geometry Seminar, Department of Mathematics, Uppsala University, Sweden, April 23, 2019.

Marco Mackaay, The 2-representation theory of Soergel bimodules, Seminar, Department of Mathematics, University of Zurich, Switzerland, June 17, 2019.

Marco Mackaay, Finitary 2-representations and (co)algebra 1-morphisms, Workshop on Representations of monoidal categories and 2-categories, University of East Anglia, Norwich, UK July 8-12, 2019.

Marco Mackaay, The 2-representation theory of Soergel bimodules of finite Coxeter type, Workshop on Representations of monoidal categories and 2-categories, University of East Anglia, Norwich, UK, July 8-12, 2019.

José Matias ,Explicit integral representations of non-local energies for structured deformations, Isaac Newton Institute for Mathematical Sciences, Cambridge, UK, June 2019

José Matias, Explicit integral representations of non-local energies for structured deformations, International Conference on Elliptic and Parabolic Problems, Gaeta, Italy, May 2019.

José Matias, Differential inclusions and A-quasiconvexity, Workshop on Calculus of Variations, Salerno, Italy, May 2019.

José Matias, Some results in the context of structured deformations, Deusto Tech, U. de Deusto, Bilbao, Spain, April 2019.

Filipe Mena, Generalizations of Hawking-Penrose singularity theorems, CMAT Open Day, Braga, Portugal, October 25, 2019

Filipe Mena, Global existence of solutions to the spherically symmetric Einstein-scalar field system, GR22, Valencia, Spain, July 7-12, 2019.

Filipe Mena, Global dynamics of SO(3) Yang-Mills and perfect fluid FLRW cosmologies, XIV Iberian Cosmology Meeting, Bilbao, Spain, April 15-17, 2019.

Filipe Mena, Dinâmica de modelos cosmológicos, Jornadas de Matemática, IST, Lisboa, Portugal, April 3-4, 2019.

Filipe Mena, Initial boundary-value problem for spherically symmetric Einstein equations, Fifth Minho Meeting on Mathematical Physics - Conference in Honour of Estelita Vaz, Guimarães, Portugal, March 29, 2019.

Margarida Mendes Lopes, Surfaces and fibrations, Workshop on Algebraic surfaces and related topics, Kochi, Japan, August 26-30, 2019.

Otávio Menezes, Relative entropy and scaling limits of interacting particle systems, Stochastic Process and its Applications, Chicago, USA, July 8, 2019.

Otávio Menezes, Relative entropy and scaling limits of interacting particle systems, Probability Seminar, Leiden University. Leiden, Netherlands. June 4, 2019.

Otávio Menezes, Relative entropy and scaling limits of interacting particle systems, Università Roma La Sapienza, Italy, May 27, 2019.

Otávio Menezes, Relative entropy and scaling limits of interacting particle systems, Probability and Analysis Seminar, Université Paris-Dauphine, France, May 22, 2019.

José Mourão, Non-uniqueness of quantization, (no-)reality conditions, complex time evolution and generalized coherent state transforms, Mathematical Physics Conference in Honour of Estelita Vaz, Universidade do Minho, March 29, 2019.

José Mourão, Complex Symplectomorphisms, Kahler Geodesics & Representation Theory, Galatasaray University, Istanbul, April 19, 2019.

José Mourão, Imaginary time Hamiltonian flows and applications to Quantization, Kahler geometry and representation theory, XXXVIII Workshop on Geometric Methods in Physics, June 30–July 6, 2019.

José Mourão, Non-uniqueness of quantization, complex time evolution and generalized coherent state transforms, Conference on Isolated Horizons and near horizon geometries, loop quantum gravity, CR structures and spacetimes, Einstein equations and the twistor equation, University of Warsaw, Poland, September 16-20, 2019.

Lina Oliveira, Hermitian projections on a $JB^*$-triple, IWOTA 2019, Instituto Superior Técnico, Portugal, July 22-27, 2019.

Lina Oliveira, Projections and multiplication operators on JB*-triples, Conference WOT19 Women in Operator Theory and its Applications, Instituto Superior Técnico, Portugal, June 17-19, 2019.

Lina Oliveira, Q-measures on the dual unit ball of a JB*-triple, AGA - Analysis Geometry and Algebra, Trinity College Dublin, Ireland, May 8-10, 2019.

José Natário, Solutions of the wave equation bounded at the Big Bang, 12th International ISAAC Congress, Aveiro, Portugal, July 2019.

José Natário, Cosmic no-hair in spherically symmetric black hole spacetimes, 22nd International Conference on General Relativity and Gravitation, Valencia, Spain, July 2019.

Roger Picken, Link invariants from finite categorical groups and a lifting of the Eisermann invariant, Loops in Leeds: Motion Groups and Related Topics, Univ. Leeds, UK, July 1-4, 2019.

João Pimentel Nunes, Quantization: future directions and open problems, Workshop Mathematical Problems in Quantization, Istanbul, September 2019.

Ricardo Schiappa, Resurgence, Topological Strings, and Enumerative Invariants, Centre for Quantum Geometry of Moduli Spaces, Aarhus University, Denmark, 2019.

Ricardo Schiappa, Resurgent Transseries and 2d Quantum Gravity, Quantum and Gravity in Okinawa, Japan, 2019.

Ricardo Schiappa, Resurgent Transseries and Painlevé Equations, Resurgence in Mathematics and Physics, IHES, Paris, France, 2019.

Ricardo Schiappa, Resurgence, Matrices, and Strings, CERN TH, Geneva, Switzerland, 2019.

Ricardo Schiappa, Resurgence in Minimal Strings and Matrix Models, Institute for Theoretical Physics, University of Amsterdam, The Netherlands, 2019.

Ricardo Schiappa, Resurgence and Topological Strings, Department of Mathematics, Capital National University, Beijing, China, 2019.

Ricardo Schiappa, Introduction to Resurgence and Transseries, Invited Lectures at Graduate Mini Course on Resurgence in Mathematics and Physics, Beijing, China, 2019.

Juha Videman, Stabilized/Nitsche's Methods for Contact Problems, Seminário, FCUL, Lisbon, Portugal, January 8, 2019.

# 6 Postdoctoral program and research fellows

The following postdoctoral or research fellows were hosted by the Center in 2019:

## 6.1 Postdoctoral fellows

**Pedro Boavida de Brito**, PhD in Mathematics, WWU-Münster & University of Aberdeen, 2014. Research areas: Algebraic Topology. Supported by an FCT postdoctoral grant (Dec. 2015–Nov. 2021).

**Chiara Franceschini**, PhD in Mathematics, Università degli studi di Ferrara, 2018. Research areas: interacting particle systems and their scaling limit, stochastic duality theory and non-equilibrium statistical mechanics. Supported by the ERC starting grant HyLEF 2016 (Jan. 2019–Jan. 2021).

**Anne Franzen**, PhD in Theoretical Physics, Utrecht University, 2015. Research areas: General Relativity: wave equation in black hole backgrounds, perturbations of black holes. Supported by the CAMGSD postdoctoral program (Jan. 2016–Dec. 2017) and by an FCT postdoctoral grant (Jan. 2018–Dec. 2020).

**Phillipo Lappicy**, PhD in Mathematics, Freie Universität Berlin, 2017. Research areas: Dynamical systems generated by parabolic partial differential equations. Supported by FAPESP-BEPE-2019 (Febr. 2019–Febr. 2020).

**Otávio de Macedo Menezes**, PhD in Mathematics, Instituto Nacional de Matemática Pura e Aplicada, 2017. Research Areas: Interacting Particles Systems. Supported by the ERC starting grant HyLEF 2016 (Nov. 2017-Jul. 2019).

**Alessandra Occelli**, PhD in Stochastic Analysis, University of Bonn, 2019. Research areas: Probability and stochastic analysis: interacting particle systems, KPZ universality. Supported by the ERC starting grant HyLEF 2016 (Oct. 2019 –Oct. 2021).

## 6.2 Research fellows

**Artur Alho**, PhD in Mathematics, Universidade do Minho, 2012. Research areas: General Relativity – Dynamical Systems in Cosmology and Astrophysics. Supported by an FCT postdoctoral grant (April 2013–Oct. 2018) and through the DL 57/2016 researcher program (since Nov. 2018).

**Manuel Araújo**, PhD in Mathematics, Oxford University, 2017. Research areas: Topology, particularly TQFT and related higher algebraic and categorical structures, Supported by an FCT project researcher contract (Sept. 2019 - June 2021).

**Thomas Baier**, PhD in Mathematics, Instituto Superior Técnico, Universidade Técnica de Lisboa, 2009. Research areas: Kähler geometry and quantization. Supported by an FCT project grant (April 2016–Sept. 2018) and through the DL 57/2016 researcher program (since Oct. 2018).

**Farid Bozorgnia**, PhD in Applied Mathematics, Royal Institute of Technology, Stockholm, Sweden, 2009. Research Areas: partial differential equations, calculus of variations, spectral theory. Supported by the UT Austin/Portugal Program (August 2010–Nov. 2011) and by FCT via postdoctoral grant (June 2012–Feb. 2017, August–Dec. 2018) and through the DL 57/2016 researcher program (since Jan. 2019).

**Luís 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 FCT via postdoctoral grant (May 2013–Oct. 2018) and through the DL 57/2016 researcher program (since Nov. 2018).

**Leonardo De Carlo**, PhD in Mathematics, Gran Sasso Science Institute, 2017. Research Areas: Interacting Particles Systems. Supported by an ERC project grant (Sept. 2017–Dec. 2017, Mar. 2019-Nov. 2020).

**Gonçalo Aprá Dias**, PhD in Theoretical Physics, IST, 2008. Research areas: fluid mechanics, water waves. Supported by an FCT postdoctoral grant (Oct. 2010–Sep. 2016) and through the DL 57/2016 researcher program (since Jan. 2019).

**João Esteves**, PhD in Physics, Instituto Superior Técnico, Universidade Técnica de Lisboa, 2011. Research area: Combinatorics and its applications to Topological Quantum Field Theory. Supported by the CAMGSD postdoctoral program (Nov. 2011–Jan. 2012) and by FCT via postdoctoral grant (Feb. 2012–Jan. 2018, June-Oct. 2018) and through the DL 57/2016 researcher program (since Nov. 2018).

**Emilio Franco**, PhD in Mathematics, Universidad Autónoma de Madrid, 2012. Research area: Algebraic Geometry. Supported by an FCT Assistant Researcher Contract (since June 2019–May 2025).

**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 the CAMGSD postdoctoral program (Jan. 2013–June 2014) and by FCT via postdoctoral grant (July 2014–Oct. 2018) and through the DL 57/2016 researcher program (since Nov. 2018).

**Suresh Nampuri**, PhD in Physics, Tata Institute of Fundamental Research, 2012. Research areas: uncovering mathematical structures in the Hilbert space of quantum gravity. Supported by FCT via project grant (June 2015–May 2018) and through the DL 57/2016 researcher program (since Nov. 2018).

**Marco Stošić**, PhD in Mathematics, Instituto Superior Técnico, Universidade Técnica de Lisboa, 2006. Research areas: knot invariants and categorification. Supported by an ERC grant and by CAMGSD (Jan. 2015-Dec. 2016) and by an FCT Researcher Contract (Jan. 2017-Dec. 2021).

**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 FCT via postdoctoral grant (Oct. 2012–Sept. 2018) and through the DL 57/2016 researcher program (since Dec. 2018).

# 7 Student supervision

## 7.1 Doctoral theses

The following doctoral theses were completed in 2019 under the supervision of members of the Center:

**Nguyen Bin**. *Surfaces of General Type with non-biratonial Canonical Map*, PhD in Mathematics awarded by Instituto Superior Técnico. October 2019. Advised by **Margarida Mendes Lopes**.

**Davide Polini**. *Classifying and Counting $N = 2$ BPS Black Holes in an STU Model*, PhD in Mathematics awarded by Instituto Superior Técnico. October 2019. Advised by **Gabriel Lopes Cardoso**.

## 7.2 Master theses

The following master theses were completed in 2019 under the supervision of members of the Center (the name of the student and of the CAMGSD advisor(s) are marked in **bold** characters):

**Frederico Toulson**. *Kneading Theory in Non-Continuous Maps The Unimodal Case* , Master in Mathematics and Applications awarded by Instituto Superior Técnico. July 2019. Advised by **Henrique Oliveira**.

**Miguel Moreira**. *Floer homology for global quotient orbifolds*, Master in Mathematics and Applications awarded by Instituto Superior Técnico. July 2019. Advised by **Miguel Abreu** and **Leonardo Macarini**.

**Marta Castro**. *Exploratory Topological Data Analysis of Resting-State fMRI Data*, Master in Mathematics and Applications awarded by Instituto Superior Técnico. July 2019. Advised by **Roger Picken**.

**Gabriel Matos**. *Geometry dependence of quantum Hall states on surfaces*, Master in Mathematics and Applications awarded by Instituto Superior Técnico. July 2019. Advised by **José Mourão**.

## 7.3 Graduate students

The following graduate students were supported by CAMGSD or FCT project fellowships in 2019:

**Carlos Couto** MSc student, supervised by José Mourão (02/12/2019-01/12/2020)

**Gabriel Matos** MSc student, supervised by José Mourão (15/03/2019 - 15/09/2019)

**Gustavo Marques** MSc student, supervised by José Mourão (15/03/2019 - 15/09/2019)

**Henrique Santos** MSc student, supervised by Henrique Oliveira (15/03/2019 - 31/12/2019)

**Miguel Moreira** MSc student, supervised by Miguel Abreu (15/03/2019 - 15/09/2019)

**Paulo Mourão** MSc student, supervised by José Natário (15/03/2019 - 31/12/2019)

**Rodrigo Serrão** MSc student, supervised by Leonor Godinho (15/03/2019 - 15/09/2019)

# 8 Publications in 2019

## 8.1 Publications which appeared in 2019

### Books & Monographs


[1] L. Barreira and C. Valls. *Dynamical Systems by Example*. Problem Books in Mathematics. Springer, 2019.

[2] L. Barreira and C. Valls. *Sistemas Dinâmicos via Exemplos*. Coleção Apoio ao Ensino. IST Press, 2019.


### Articles in refereed international journals


[1] A. Alho and S. Calogero. Multi-body spherically symmetric steady states of Newtonian self-gravitating elastic matter. *Comm. Math. Phys.*, 371(3):975–1004, 2019. arXiv:1807.03062.

[2] A. Alho, G. Fournodavlos, and A.T. Franzen. The wave equation near flat Friedmann-Lemaître-Robertson-Walker and Kasner Big Bang singularities. *J. Hyperbolic Differ. Equ.*, 16(2):379–400, 2019. arXiv:1805.12558.

[3] A. Alho, C. Uggla, and J. Wainwright. Perturbations of the Lambda-CDM model in a dynamical systems perspective. *J. Cosmol. Astropart. Phys.*, 2019(9):045, 2019. arXiv:1904.02463.

[4] M.S. Ali, M. Shamsi, H. Khosravian-Arab, D.F.M. Torres, and F. Bozorgnia. A space–time pseudospectral discretization method for solving diffusion optimal control problems with two-sided fractional derivatives. *J. Vib. Control*, 25(5):1080–1095, 2019.

[5] D. Allen, M. Grinfeld, and R. Sasportes. Point island dynamics under fixed rate deposition. *J. Math. Anal. Appl.*, 472(2):1716–1728, 2019. arXiv:1802.05535.

[6] J.D. Alvarado, S. Dantas, and R. Marinho. On adjacent-vertex-distinguishing total colourings of powers of cycles, hypercubes and lattice graphs. *Electron. Notes Theor. Comput. Sci.*, 346:41–51, 2019.

[7] I. Aniceto, G. Başar, and R. Schiappa. A primer on resurgent transseries and their asymptotics. *Phys. Rep.*, 809:1–135, 2019. arXiv:1802.10441.

[8] P. Aniceto and J.V. Rocha. Self-similar solutions and critical behavior in Einstein-Maxwell-dilaton theory sourced by charged null fluids. *J. High Energy Phys.* 2019(10):151, 2019. arXiv:1907.02715.

[9] S. Anjos and S. Eden. The homotopy lie algebra of symplectomorphism groups of 3-fold blow-ups of $(S^2 \times S^2, \sigma_{\text{std}} \oplus \sigma_{\text{std}})$. *Michigan Math. J.*, 68(1):71–126, 2019. arXiv:1702.03572.

[10] B. Anwasia, P. Gonçalves, and A.J. Soares. From the simple reacting sphere kinetic model to the reaction-diffusion system of Maxwell-Stefan type. *Commun. Math. Sci.*, 17(2):507–538, 2019. arXiv:1707.01316.

[11] L. Bakker and P. Martins Rodrigues. Block conjugacy of irreducible toral automorphisms. *Dyn. Syst.*, 34(2):244–258, 2019. arXiv:1511.00763.

[12] M. Barata and P.R. Pinto. Representations of thompson groups from Cuntz algebras. *J. Math. Anal. Appl.*, 478(1):212–228, 2019.

[13] L. Barreira, D. Dragicevic, and C. Valls. Spectrum for compact operators on Banach spaces. *J. Math. Soc. Japan*, 71(1):1–17, 2019.

[14] L. Barreira and C. Valls. $C^k$ invariant manifolds for infinite delay. *Electron. J. Differential Equations*, 2019(50):1–15, 2019.

[15] L. Barreira and C. Valls. Conjugacies and invariant manifolds via evolution semigroups. *Quaest. Math.*, 42(2):217–241, 2019.

[16] L. Barreira and C. Valls. General exponential dichotomies: from finite to infinite time. *Adv. Oper. Theory*, 4(1):215–225, 2019.

[17] L. Barreira and C. Valls. Hyperbolicity via evolution semigroups on $L^p$. *Qual. Theory Dyn. Syst.*, 18(3):887–908, 2019.

[18] L. Barreira and C. Valls. Lyapunov regularity and triangularization for unbounded sequences. *Electron. J. Qual. Theory Differ. Equ.*, 2019(53):1–31, 2019.

[19] L. Barreira and C. Valls. Normal forms via nonuniform hyperbolicity. *J. Differential Equations*, 266(4):2175–2213, 2019.

[20] L. Barreira and C. Valls. Parameter dependence of smooth stable manifolds. *J. Korean Math. Soc.*, 56(3):825–855, 2019.

[21] C. Bernardin, P. Goncalves, and B. Oviedo Jimenez. Slow to fast infinitely extended reservoirs for the symmetric exclusion process with long jumps. *Markov Process. Related Fields*, 25(2):217–274, 2019. arXiv:1702.07216.

[22] N. Bin. A new example of an algebraic surface with canonical map of degree 16. *Arch. Math. (Basel)*, 113(4):385–390, 2019.

[23] P. Boavida de Brito, G. Horel, and M. Robertson. Operads of genus zero curves and the Grothendieck-Teichmüller group. *Geom. Topol.*, 23(1):299–346, 2019. arXiv:1703.05143.

[24] M. Bohner, A. Gasull, and C. Valls. Periodic solutions of linear, Riccati, and Abel dynamic equations. *J. Math. Anal. Appl.*, 470(2):733–749, 2019.

[25] F. Bozorgnia, S. Abbas Mohammadi, and T. Vejchodsky. The first eigenvalue and eigenfunction of a nonlinear elliptic system. *Appl. Numer. Math.*, 145:159–174, 2019. arXiv:1905.12059.

[26] M.C. Câmara, K. Klis-Garlicka, and M. Ptak. Asymmetric truncated Toeplitz operators and conjugations. *Filomat*, 33(12), 2019.

[27] M.R. Cândido, J. Libre, and C. Valls. New symmetric periodic solutions for the Maxwell-Bloch differential system. *Math. Phys. Anal. Geom.*, 22(2):16, 2019.

[28] G. Carinci, C. Franceschini, C. Giardinà, W. Groenevelt, and F. Redig. Orthogonal dualities of Markov processes and unitary symmetries. *SIGMA Symmetry Integrability Geom. Methods Appl.*, 15(053):27 p., 2019. arXiv:1812.08553.

[29] L. Carvalho, C. Diogo, and S. Mendes. A bridge between quaternionic and complex numerical ranges. *Linear Algebra Appl.*, 581:496–504, 2019. arXiv:1904.02757.

[30] L. Carvalho, C. Diogo, and S. Mendes. On the convexity and circularity of the numerical range of nilpotent quaternionic matrices. *New York J. Math.*, 25:1385–1404, 2019. arXiv:1907.13438.

[31] S. Codesido, M. Marino, and R. Schiappa. Non-perturbative quantum mechanics from non-perturbative strings. *Ann. Henri Poincaré*, 20(2):543–603, 2019. arXiv:1712.02603.

[32] M. Corbera and C. Valls. On centered co-circular central configurations of the $n$-body problem. *J. Dynam. Differential Equations*, 31(4):2053–2060, 2019.

[33] A. Corcho, S. Correia, F. Oliveira, and J. D. Silva. On a nonlinear Schrödinger system arising in quadratic media. *Commun. Math. Sci.*, 17(4):969–987, 2019. arXiv:1703.10509.

[34] J. L. Costa and J. Natário. Elastic shocks in relativistic rigid rods and balls. *Proc. R. Soc. Lond. Ser. A Math. Phys. Eng. Sci.*, 475(20180852), 2019. arXiv:1811.12424.

[35] J. L. Costa, P. Oliveira, and J. Natário. Cosmic no-hair in spherically symmetric black hole spacetimes. *Ann. Henri Poincaré*, 20(9):3059–3090, 2019. arXiv:1801.06549.

[36] J. L. Costa, P. Oliveira, and J. Natário. Decay of solutions of the wave equation in expanding cosmological spacetimes. *J. Hyperbolic Differ. Equ.*, 16(1):35–58, 2019. arXiv:1801.08944.

[37] K. Destounis, R.D.B. Fontana, F.C. Mena, and E. Papantonopoulos. Strong cosmic censorship in Horndeski theory. *J. High Energy Phys.*, 2019(10):280, 2019. arXiv:1908.09842.

[38] F. S. Dias, J. Llibre, and C. Valls. $\mathbb{Z}_2$-symmetric planar polynomial Hamiltonian systems of degree 3 with nilpotent centers. *Electron. J. Differential Equations*, 2019(82):1–29, 2019.

[39] M. Dodig and M. Stošić. Feedback invariants of series connected systems. *Linear Algebra Appl.*, 577:244–269, 2019.

[40] M. Dodig and M. Stošić. The general matrix pencil completion problem – a minimal case. *SIAM J. Matrix Anal. Appl.*, 40(1):347–369, 2019.

[41] J. Duarte, C. Januário, N. Martins, S. Rogovchenko, and Y. Rogovchenko. Chaos analysis and explicit series solutions to the seasonally forced SIR epidemic model. *J. Math. Biol.*, 78(7):2235–2258, 2019.

[42] C.M. Edwards and L. Oliveira. $Q$-measures on the dual unit ball of a JB$^*$-triple. *J. Korean Math. Soc.*, 56(1):197–224, 2019.

[43] A. Ferragut, J. D. García-Saldaña, and C. Valls. Phase portraits of abel quadratic differential systems of second kind with symmetries. *Dyn. Syst.*, 34(2):301–333, 2019.

[44] B. Fiedler and C. Rocha. Sturm 3-ball global attractors 2: Design of Thom-Smale complexes. *J. Dynam. Differential Equations*, 31(3):1549–1590, 2019. arXiv:1704.00344.

[45] T. Franco, P. Gonçalves, and A. Neumann. Non-equilibrium and stationary fluctuations of a slowed boundary symmetric exclusion. *Stochastic Process. Appl.*, 129(4):1413–1442, 2019. arXiv:1608.04317.

[46] A. García-Parrado and F. C. Mena. Gravitational radiation and the evolution of gravitational collapse in cylindrical symmetry. *Differential Geom. Appl.*, 64:29–46, 2019. arXiv:1811.10303.

[47] J. Giné, J. Llibre, and C. Valls. Chiellini Hamiltonian Liénard differential systems. *Electron. J. Differential Equations*, 2019(71):1–8, 2019.

[48] J. Giné and C. Valls. Liouvillian integrability of a general Rayleigh-Duffing oscillator. *J. Nonlinear Math. Phys.*, 26(2):169–187, 2019.

[49] J. Giné and C. Valls. The liouvillian integrability of several oscillators. *Internat. J. Bifur. Chaos Appl. Sci. Engrg.*, 29(05):1950069, 2019.

[50] J. Giné and C. Valls. On the dynamics of the Rayleigh-Duffing oscillator. *Nonlinear Anal. Real World Appl.*, 45:309–319, 2019.

[51] P.M. Girão, J. Natário, and J. Drumond Silva. Solutions of the wave equation bounded at the Big Bang. *Classical Quantum Gravity*, 36(7):075016, 2019. arXiv:1809.09633.

[52] K. Goldstein, V. Jejjala, J.J. Mashiyane, and S. Nampuri. Generalized hot attractors. *J. High Energy Phys.*, 2019(3):188, 2019. arXiv:1811.04963.

[53] P. Gonçalves and M. Jara. Quadratic fluctuations of the symmetric simple exclusion. *ALEA*, 16:605–652, 2019.

[54] T. Gustafsson, R. Stenberg, and J. Videman. Error analysis of nitsche's mortar method. *Numer. Math.*, 142(973-994), 2019. arXiv:1802.10430.

[55] T. Gustafsson, R. Stenberg, and J. Videman. A stabilised finite element method for the plate obstacle problem. *BIT*, 59(1):97–124, 2019. arXiv:1711.04166.

[56] D. Hein, U. Hryniewicz, and L. Macarini. Transversality for local Morse homology with symmetries and applications. *Math. Z.*, 293(3-4):1513–1599, 2019.

[57] J. Huerta. How space-times emerge from the superpoint. *Fortschr. Phys.*, 67(8-9):1910009, 2019. arXiv:1903.02822.

[58] J. Huerta, H. Sati, and U. Schreiber. Real ADE-equivariant (co)homotopy and Super M-branes. *Comm. Math. Phys.*, 371(2):425–524, 2019. arXiv:1805.05987.

[59] T. Kildetoft, M. Mackaay, V. Mazorchuk, and J. Zimmermann. Simple transitive 2-representations of small quotients of Soergel bimodules. *Trans. Amer. Math. Soc.*, 371:5551–5590, 2019. arXiv:1605.01373.

[60] P. Kucharski, M. Reineke, M. Stosic, and P. Sulkowski. Knots-quivers correspondence. *Adv. Theor. Math. Phys.*, 23(7), 2019. arXiv:1707.04017.

[61] A. Lages and P. Lopes. Quandles of cyclic type with several fixed points. *Electron. J. Combin.*, 26(3):P3.42, 2019. arXiv:1803.10487.

[62] J. Llibre, R.D.S. Oliveira, and C. Valls. Final evolutions for simplified multistrain/two-stream model for tuberculosis and dengue fever. *Chaos Solitons Fractals*, 118:181–186, 2019.

[63] J. Llibre, E. Ponce, and C. Valls. Two limit cycles in Liénard piecewise linear differential systems. *J. Nonlinear Sci.*, 29(4):1499–1522, 2019.

[64] J. Llibre and C. Valls. Global dynamics of the integrable Armbruster-Guckenheimer-Kim galactic potential. *Astrophys. Space Sci.*, 364(8):130, 2019.

[65] J. Llibre and C. Valls. Integrability of reversible and equivariant quadratic polynomial differential systems in the plane. *Rocky Mountain J. Math.*, 49(2):579–591, 2019.

[66] J. Llibre and C. Valls. On the dynamics of the Szekeres system. *Phys. Lett. A*, 383(4):301–305, 2019.

[67] J. Llibre and C. Valls. Periodic orbits of the planar anisotropic generalized Kepler problem. *J. Math. Phys.*, 60(4):042901, 2019.

[68] P. Lopes. Removing colors $2k$, $2k-1$, and $k$. *J. Knot Theory Ramifications*. 28(13):1940013, 2019. arXiv:1308.5278.

[69] R. Luna, M. Zilhão, V. Cardoso, J.L. Costa, and J. Natário. Strong cosmic censorship: the nonlinear story. *Phys. Rev. D (3)*, 99(064014):9 p., 2019. arXiv:1810.00886.

[70] P. Luz and S. Carloni. Static compact objects in Einstein-Cartan theory. *Phys. Rev. D (3)*, 100(8):084037, 2019. arXiv:1907.11489.

[71] P. Luz, F.C. Mena, and A. Hadi Ziaie. Influence of intrinsic spin in the formation of singularities for inhomogeneous effective dust space-times. *Classical Quantum Gravity*, 36(1):015003, 2019. arXiv:1811.12292.

[72] M. Mackaay, V. Mazorchuk, V. Miemietz, and D. Tubbenhauer. Simple transitive 2-representations via (co)algebra 1-morphisms. *Indiana Univ. Math. J.*, 68(1):1–33, 2019. arXiv:1612.06325.

[73] M. Mackaay and D. Tubbenhauer. Two-color Soergel calculus and simple transitive 2-representations. *Canad. J. Math.*, 71(6):1523–1566, 2019. arXiv:1609.00962.

[74] M. Mackaay and Y. Yonezawa. $\mathfrak{sl}_n$-web categories and categorified skew Howe duality. *J. Pure Appl. Algebra*, 223(5):2173–2229, 2019.

[75] J. Mourão, J.P. Nunes, and T. Reis. A new approximation method for geodesics on the space of Kahler metrics. *Anal. Math. Phys.*, 9(4):1927–1939, 2019. arXiv:1701.01709.

[76] J. E. Nelson and R.F. Picken. Quantum holonomies and the Heisenberg group. *Modern Phys. Lett. A*, 34(31):1950256, 2019.

[77] W.M.Oliva and G. Terra. Improving E. Cartan considerations on the invariance of nonholonomic mechanics. *J. Geom. Mech.*, 11(3):439–446, 2019.

[78] L. Oliveira. A note on the uniqueness of Hahn-Banach extensions. *Math. Proc. R. Ir. Acad.*, 119A(2):157–171, 2019.

[79] B.M.M. Pereira, G.A.S. Dias, F.S. Cal, K.R. Rajagopal, and J.H. Videman. Lubrication approximation for fluids with shear-dependent viscosity. *Fluids*, 4(2):98, 2019.

[80] D. Polini. Generating new $n = 2$ small black holes. *J. High Energy Phys.*, 2019(6:1), 2019.

[81] J.P.Quijano and P. Resende. Effective equivalence relations and principal quantales. *Semigroup Forum*, 99(3):754–787, 2019. arXiv:1807.08979.

[82] C. Correia Ramos, N. Martins, and P.R. Pinto. Escape dynamics for interval maps. *Discrete Contin. Dyn. Syst.*, 39(11):6240–6260, 2019.

[83] C. Correia Ramos, N. Martins, and P.R. Pinto. On graph algebras from interval maps. *Annal. Funct. Anal.*, 10(2):203–217, 2019. arXiv:1807.07503.

[84] R. Sena-Dias. Critical Kähler toric metrics for the invariant first eigenvalue. *Math. Res. Lett.*, 26(3):851–873, 2019. arXiv:1708.04077.

[85] A. Shafie and F. Bozorgnia. A note on the paper "optimality conditions for vector optimization problems with difference of convex maps". *J. Optim. Theory Appl.*, 182(2):837–849, 2019. arXiv:1902.03292.

[86] M. Stošić. On extended graphical calculus for categorified quantum $sl(n)$. *J. Pure Appl. Algebra*, 223(2):691–712, 2019. arXiv:1605.06810.

[87] C. Valls. Algebraic approach to the classification of centers in trigonometric cherkas systems. *Proc. Amer. Math. Soc.*, 147(7):2863–2875, 2019.

[88] C. Valls. Invariant algebraic surfaces and algebraic first integrals of the Maxwell-Bloch system. *J. Geom. Phys.*, 146:103516, 2019.

[89] C. Valls. Liouvillian integrability of some quadratic Liénard polynomial differential systems. *Rend. Circ. Mat. Palermo (2)*, 68(3):499–519, 2019.

[90] C. Valls. On the global dynamics of the Newell-Whitehead system. *J. Nonlinear Math. Phys.*, 26(4):569–578, 2019.

[91] C. Valls and J. Giné. Global $C^\infty$ integrability of quartic-linear polynomial differential systems. *Dyn. Syst.*, 34(1):1–13, 2019.

**Book chapters**

[1] M.C. Câmara and C. Carteiro. Toeplitz kernels and finite rank truncated Toeplitz operators. In F. Botelho, editor, *Recent Trends in Operator Theory and Applications*, volume 737 of *Contemporary Mathematics*, pages 43–62. AMS, 2019.

[2] P. Gonçalves. Hydrodynamics for symmetric exclusion in contact with reservoirs. In G. Giacomin, S. Olla, E. Saada, H. Spohn, and G. Stoltz, editors, *Stochastic Dynamics Out of Equilibrium*, volume 282 of *Springer Proceedings in Mathematics & Statistics*, pages 137–205. Springer, 2019. arXiv:1803.11460.

[3] T. Gustafsson, R. Stenberg, and J. Videman. Nitsche's method for the obstacle problem of clamped Kirchhoff plates. In A. F. Radu, K. Kumar, I. Berre, J. M. Nordbotten, and I. S. Pop, editors, *Numerical Mathematics and Advanced Applications - ENUMATH 2017*, volume 126 of *Lecture Notes in Computational Science and Engineering*, pages 407–415. Springer, 2019.

[4] D. Ilišević and L. Oliveira When is a finite sum of box operators on a JB$^*$-triple a Hermitian projection? In F. Botelho, editor, *Recent Trends in Operator Theory and Applications*, volume 737 of *Contemporary Mathematics*, pages 107–117. AMS, 2019.

**Communications in refereed proceedings**

[1] R. Luís. On the stability of 1D discrete dynamical systems: applications to population dynamics. In F. Morgado Dias and F. Quintal, editors, *Proceedings of the International Conference on Mathematical Applications 2019 - ICMA 2019*, pages 25–33. Institute of Knowledge and Development, 2019.

**Other publications**

[1] D. Bragança and R. Picken. Invariants and TQFT's for cut cellular surfaces from finite 2-groups. *Bol. Soc. Port. Mat.*, 76:159–176, 2018. (published in 2019) arXiv:1710.02390.

[2] S.B.S.D. Castro and M. Mendes Lopes Um retrato das mulheres matemáticas em Portugal. *Bol. Soc. Port. Mat.*, 76:181–192, 2018. (published in 2019)

[3] C. Franceschini and P. Gonçalves. An interview with Martin Hairer. *CIM Bulletin*, 41:55–59, 2019.

## 8.2 Accepted publications (submitted or accepted in 2019)

**Articles in refereed international journals**

[1] M. Abreu, J. Gutt, J. Kang, and L. Macarini. Two closed orbits for non-degenerate Reeb flows. *Math. Proc. Cambridge Philos. Soc.*. To appear. arXiv:1903.06523.

[2] B. Anwasia, P. Gonçalves, and A.J. Soares. On the formal derivation of the reactive Maxwell-Stefan equations from the kinetic theory. *Europhys. Letters.*. To appear. .

[3] L. Barreira, J. Llibre, and C. Valls. Bounded polynomial vector fields in $\mathbb{R}^2$ and $\mathbb{R}^n$. *J. Differential Equations*. To appear.

[4] L. Barreira, L.H. Popescu, and C. Valls. Nonuniform exponential behavior via evolution semigroups. *Mathematika*. To appear.

[5] L. Barreira, J. Rijo, and C. Valls. Characterization of tempered exponential dichotomies. *J. Korean Math. Soc.* To appear.

[6] L. Barreira and C. Valls. Admissibility in the strong and weak senses. *Qual. Theory Dyn. Syst.* To appear.

[7] L. Barreira and C. Valls. Robustness of hyperbolicity in delay equations. *J. Dynam. Differential Equations*. To appear.

[8] L. Barreira and C. Valls. Equivalent notions of hyperbolicity. *Dyn. Syst.* To appear.

[9] L. Barreira and C. Valls. Regularity and stability sets for families of sequences of matrices. *J. Dynam. Differential Equations*. To appear.

[10] C. Bernardin, P. Gonçalves, and B. Oviedo. A microscopic model for regional fractional Laplacian with Dirichlet boundary conditions. *Arch. Ration. Mech. Anal.* To appear. arXiv:1803.00792.

[11] N. Bin. Some unlimited families of minimal surfaces of general type with the canonical map of degree 8. *Manuscripta Math.* To appear.

[12] L. Bonorino, R. De Paula, P. Gonçalves, and A. Neumann. Hydrodynamics of porous medium model with slow reservoirs. *J. Statist. Phys.* To appear. arXiv:1904.10374.

[13] M.C. Câmara, K. Kliš-Garlicka, and M. Ptak. Complex symmetric completions of partial operator matrices. *Linear Multilinear Algebra*. To appear.

[14] M.R. Cândido, J. Llibre, and C. Valls. Non-existence, existence, and uniqueness of limit cycles for a generalization of the Van der Pol-Duffing and the Rayleigh-Duffing oscillators. *Phys. D.* To appear.

[15] G.L. Cardoso, B. de Wit, and S. Mahapatra. Exact results for an STU-model. *J. High Energy Phys.* To appear. arXiv:1907.04077.

[16] G.L. Cardoso and T. Mohaupt. Special geometry, Hessian structures and applications. *Phys. Rep.* To appear. arXiv:1909.06240.

[17] R.P. Carpentier and R. Picken. Some properties of Bowlin and Brin's color graphs. *Discrete Math.* To appear. arXiv:1804.08397.

[18] M. Corbera and C. Valls. Global phase portraits of $\mathbb{Z}_2$-symmetric planar polynomial Hamiltonian systems of degree three with a nilpotent saddle at the origin. *Internat. J. Bifur. Chaos Appl. Sci. Engrg.* To appear.

[19] S. Correia, R. Côte, and L. Vega. Self-similar dynamics for the modified Korteweg–de Vries equation. *Int. Math. Res. Not.* To appear. arXiv:1904.04524.

[20] I. Cruz, H. Mena-Matos, and E. Sousa-Dias. The group of symplectic birational maps of the plane and the dynamics of a family of 4D maps. *J. Geom. Mech.* To appear.

[21] F.P. da Costa, M. Drmota, and M. Grinfeld. Modelling silicosis: The structure of equilibria. *European J. Appl. Math.* To appear. arXiv:1901.10670.

[22] S. Dantas, R. Marinho, and S. Tanushevski. The solitaire Clobber game and correducibility of graphs. *Discrete Appl. Math.* To appear.

[23] M.V. Demina and C. Valls. On the Poincaré problem and Liouvillian integrability of quadratic Liénard differential equations. *Proc. Roy. Soc. Edinburgh Sect. A*. To appear.

[24] F.S. Dias, J. Llibre, and C. Valls. Global dynamics of a virus model with invariant algebraic surfaces. *Rend. Circ. Mat. Palermo (2)*. To appear.

[25] M. Dodig and M. Stošić. Combinatorics of polynomial chains. *Linear Algebra Appl.* To appear.

[26] B. Fiedler and C. Rocha. Boundary orders and geometry of the signed Thom-Smale complex for Sturm global attractors. *J. Dynam. Differential Equations*. To appear. arXiv:1811.04206.

[27] A.T. Franzen. Boundedness of massless scalar waves on Kerr interior backgrounds. *Ann. Henri Poincare*. To appear. arXiv:1908.10856.

[28] J.D. García-Saldaña, J. Llibre, and C. Valls. Nilpotent global centers of linear systems with cubic homogeneous nonlinearities. *Internat. J. Bifur. Chaos Appl. Sci. Engrg.* To appear.

[29] J.D. García-Saldaña, J. Llibre, and C. Valls. Linear type global centers of linear systems with cubic homogeneous nonlinearities. *Rend. Circ. Mat. Palermo (2)*. To appear.

[30] A. Gasull, J. Giné, and C. Valls. Highest weak focus order for trigonometric Liénard equations. *Ann. Mat. Pura Appl. (4)*. To appear.

[31] J. Giné and C. Valls. Nonlinear oscillations in the modified Leslie-Gower model. *Nonlinear Anal. Real World Appl.* To appear.

[32] J. Giné and C. Valls. Small-Amplitude Limit Cycles of Certain Planar Differential Systems. *Qual. Theory Dyn. Syst.* To appear.

[33] P. Gonçalves, M. Jara, O. Menezes, and A. Neumann. Non-equilibrium and stationary fluctuations for a slowed boundary symmetric exclusion. *Stochastic Process. Appl.* To appear. arXiv:1810.05015.

[34] G. Granja, Y. Karshon, M. Pabiniak, and S. Sandon. Givental's nonlinear Maslov index on lens spaces. *Int. Math. Res. Not.* To appear. arXiv:1704.05827.

[35] T. Gustafsson, R. Stenberg, and J. Videman. On Nitsche's method for elastic contact problems. *SIAM J. Sci. Comput.* To appear. arXiv:1902.09312.

[36] L.H. Kauffman and P. Lopes. The prevalence of persistent tangles. *Topology Appl.* To appear. arXiv:1904.05951.

[37] J. Llibre, A.C. Murza, and C. Valls. On a conjecture on the integrability of Liénard systems. *Rend. Circ. Mat. Palermo (2).* To appear.

[38] J. Llibre and C. Valls. Centers of planar generalized Abel equations. *J. Differential Equations.* To appear.

[39] J. Llibre and C. Valls. Global qualitative dynamics of the Brusselator system. *Math. Comput. Simulation.* To appear.

[40] R. Luís and S. Mendonça. A note on global stability in the periodic logistic map. *Discrete Contin. Dyn. Syst. Ser. B.* To appear.

[41] M. Mackaay, V. Mazorchuk, V. Miemietz, and D. Tubbenhauer. Trihedral Soergel bimodules. *Fund. Math.* To appear. arXiv:1804.08920.

[42] Y. Paulina Martínez and C. Valls. On the global dynamics and integrability of the Chemostat system. *Nonlinear Anal. Real World Appl.* To appear.

[43] G. Matos and L. Oliveira. Kernel maps and operator decomposition. *Banach J. Math. Anal.* To appear. arXiv:1902.07689.

[44] J.C. Morton and R. Picken. 2-group actions and moduli spaces. *J. Geom. Phys.* To appear.

[45] J. Natário and R. Vicente. Test fields cannot destroy extremal de Sitter black holes. *Gen. Relativity Gravitation.* To appear. arXiv:1908.09854.

[46] R. Oliveira and C. Valls. On the Abel differential equations of third kind. *Discrete Contin. Dyn. Syst. Ser. B.* To appear.

[47] H. Tavares and S. You. Existence of least energy positive solutions to Schrödinger systems with mixed competition and cooperation terms: the critical case. *Calc. Var. Partial Differential Equations.* To appear. arXiv:1908.11090.

[48] C. Valls. Integrable weak saddles for trigonometric Liénard systems. *J. Dynam. Control Systems.* To appear.

[49] C. Valls. On the polynomial solutions of general polynomial differential equations. *Mathematica.* To appear.

### 8.3 Manuscripts submitted (but not yet accepted) in 2019

[1] R. Ahmed, C. Bernardin, P. Gonçalves, and M. Simon. A microscopic derivation of coupled SPDE's with a KPZ flavor. arXiv:1910.03996.

[2] A. Alho, V. Bessa, and F.C. Mena. Global dynamics of the Einstein-Euler-Yang-Mills system in flat Robertson-Walker cosmologies. arXiv:1910.04678.

[3] A. Alho and S. Calogero. Static self-gravitating Newtonian elastic balls. arXiv:1907.09970.

[4] G. Amir, O. Busani, P. Gonçalves, and J.B. Martin. The TAZRP speed process. arXiv:1911.06504.

[5] P. Aniceto, M.C. Câmara, G.L. Cardoso, and M. Rosselló. Weyl metrics and Wiener-Hopf factorization. arXiv:1910.10632.

[6] S. Anjos, M. Barata, and A.A. Reis. Loops in the fundamental group of symp($\mathbb{CP}\#5\overline{\mathbb{CP}}^2$) which are not represented by circle actions. arXiv:1910.02796.

[7] S. Anjos, J. Li, T.-J. Li, and M. Pinsonnault. Stability of the symplectomorphism group of rational surfaces. arXiv:1911.00961.

[8] C. Bernardin, P. Gonçalves, and S. Scotta. Hydrodynamic limit for a boundary driven super-diffusive symmetric exclusion.

[9] D. Berwick-Evans, P. Boavida de Brito, and D. Pavlov. Classifying spaces of infinity-sheaves. arXiv:1912.10544.

[10] P. Boavida de Brito and G. Horel. On the formality of the little disks operad in positive characteristic. arXiv:1903.09191.

[11] L. Bonorino, R. De Paula, P. Gonçalves, and A. Neumann. Hydrodynamics of porous medium model with slow reservoirs. arXiv:1904.10374.

[12] F. Bozorgnia. Approximation of the second eigenvalue of the $p$-Laplace operator in symmetric domains. arXiv:1907.13390.

[13] F. Bozorgnia and M. Burger. On a class of singularly perturbed elliptic systems with asymptotic phase segregation. arXiv:1901.08750.

[14] F. Bozorgnia and P. Lewintan. Decay estimate for the solution of the evolutionary damped $p$-Laplace equation. arXiv:1905.03597.

[15] M.C. Câmara, K. Kliš-Garlicka, B. Łanucha, and M. Ptak. Conjugations in $L^2$ and their invariants. arXiv:1912.13265.

[16] M.C. Câmara, K. Kliš-Garlicka, B. Łanucha, and M. Ptak. Conjugations in $L^2(\mathcal{H})$. arXiv:1912.13270.

[17] M.C. Câmara, K. Kliš-Garlicka, B. Łanucha, and M. Ptak. Invertibility, Fredholmness and kernels of dual truncated Toeplitz operators. arXiv:1912.13266.

[18] M. Cândido and C. Valls. Zero-hopf bifurcation in the general van der Pol-Duffing equation. arXiv:1906.02335.

[19] M.R. Cândido, D.D. Novaes, and C. Valls. Periodic solutions and invariant torus in the Rössler system. arXiv:1903.02398.

[20] G.L. Cardoso, S. Nampuri, and D. Polini. An approach to bps black hole microstate counting in an $N = 2$ STU model. arXiv:1903.07586.

[21] L. Carvalho, C. Diogo, and S. Mendes. The star-center of the quaternionic numerical range. arXiv:1907.13433.

[22] J.P. Chen and P. Gonçalves. Asymptotic behavior of density in the boundary-driven exclusion process on the Sierpinski gasket. arXiv:1904.08789.

[23] S. Correia, F. Oliveira, and J.D. Silva. Mass-transfer instability of ground-states for Hamiltonian Schrödinger systems. arXiv:1912.09691.

[24] S. Correia and J.D. Silva. Nonlinear smoothing for dispersive PDE: a unified approach. arXiv:1911.11076.

[25] J.L. Costa and P.M. Girão. Higher order linear stability and instability of Reissner-Nordström's Cauchy horizon. arXiv:1902.10726.

[26] L.F.O. Costa and J. Natário. Gravitomagnetism in the Lewis cylindrical metrics. arXiv:1912.09407.

[27] L. De Carlo. Discrete calculus with cubic cells on discrete manifolds. arXiv:1906.07054.

[28] F.P. da Costa, M. Grinfeld, J.T.Pinto, and K. Xayxanadasy. Bifurcating solutions in a non-homogeneous boundary value problem for a nonlinear pendulum equation. arXiv:1907.13009.

[29] E. D'Aniello and H. Oliveira. Huygens synchronisation of three clocks equidistant from each other. arXiv:1905.03534.

[30] M. Dodig and M. Stošić. More on the properties of the generalized majorization. arXiv:1905.08053.

[31] C. Erignoux, P. Gonçalves, and G. Nahum. Hydrodynamics for SSEP with non-reversible slow boundary dynamics: Part I, the critical regime and beyond. arXiv:1912.09841.

[32] C. Erignoux, P. Gonçalves, and G. Nahum. Hydrodynamics for SSEP with non-reversible slow boundary dynamics: Part II, below the critical regime. arXiv:1912.09842.

[33] V.L. Ginzburg and L. Macarini. Dynamical convexity and closed orbits on symmetric spheres. arXiv:1912.04882.

[34] L. Godinho and A. Mandini. Quasi-parabolic Higgs bundles and null hyperpolygon spaces. arXiv:1907.01937.

[35] T. Gustafsson, R. Stenberg, and J. Videman. Nitsche's master-slave method for elastic contact problems. arXiv:1912.08279.

[36] D. Jaramillo, M. Vaz Pinto, and R.H. Villarreal. Projective toric codes over hypersimplices. arXiv:1907.13217.

[37] W.D. Kirwin, J. Mourão, J.P. Nunes, and T. Thiemann. Holomorphic fractional Fourier transforms. arXiv:1905.04116.

[38] W.D. Kirwin, J. Mourão, J.P. Nunes, and T. Thiemann. Segal-Bargmann transforms from hyperbolic Hamiltonians. arXiv:1902.08751.

[39] F. Linares, A. Pastor, and J. Drumond Silva. Dispersive blow-up for solutions of the Zakharov-Kuznetsov equation. arXiv:1911.10834.

[40] P. Luz and F.C. Mena. Singularity theorems and the inclusion of torsion in affine theories of gravity. arXiv:1909.00018.

[41] M. Mackaay, V. Mazorchuk, V. Miemietz, D. Tubbenhauer, and X. Zhang. 2-representations of Soergel bimodules. arXiv:1906.11468.

[42] J. Matias, M. Morandotti, D.R. Owen, and E. Zappale. Relaxation of non-local energies for structured deformations with applications to plasticity. arXiv:1907.02955.

[43] J.M. Mourão, J.P. Nunes, and M.B. Pereira. Partial coherent state transforms, $G \times T$-invariant Kähler structures and geometric quantization of cotangent bundles of compact Lie groups. arXiv:1907.05232.

[44] J. Natário. Rigid elastic solids in relativity. arXiv:1912.08221.

[45] J. Natário and A. Sasane. Decay of solutions to the Klein-Gordon equation on some expanding cosmological spacetimes. arXiv:1909.01292.

[46] J. Neves, M. Vaz Pinto, and R.H. Villarreal. Joins, ears and Castelnuovo-Mumford regularity. arXiv:1909.02773.

[47] R. Sena-Dias. Uniqueness among scalar-flat Kähler metrics on non-compact toric 4-manifolds. arXiv:1908.09789.

# 9 Editorialships

**Miguel Abreu**

- Portugaliae Mathematica

**Luís Barreira**

- Chaos, Solitons & Fractals
- Dynamical Systems: An International Journal
- Khayyam Journal of Mathematics
- Nonlinear Analysis: Real World Applications
- Revista Matemática Iberoamericana

**Patrícia Gonçalves**

- ALEA - Latin American Journal of Probability and Mathematical Statistics
- Annals of Applied Probability
- Electronic Journal of Probability and Electronic Communications in Probability

**Pedro Lopes**

- Journal of Knot Theory and Its Ramifications
- Open Mathematics

**Waldyr Oliva**

- São Paulo Journal of Mathematical Sciences

**Fernando Pestana da Costa**

- Newsletter of the European Mathematical Society

**Pedro Resende**

- Surveys in Mathematics and Applications

**Carlos Rocha**

- Journal Proceedings of the Institute of Mathematics and Mechanics of the Academy of Azerbaijan.

**Claudia Valls**

- Chaos, Solitons & Fractals
- Nonlinear Analysis: Real World Applications

**Juha Videman**

- Applications in Engineering Science
- Fluids

# 10 Partnership and outreach

### Participation in the Programme Novos Talentos em Matemática

Supervision of research projects carried out by talented undergraduate students funded by ten month scholarships from the Gulbenkian Foundation.

### Participation in the IST Mathematics Winter School for Undergraduates

*Escola de Inverno de Matemática 2019 (EIM2019)*, IST, February 6–8, 2019.

### Outreach activities by individual members

**Luís Filipe Costa** gave the public talk "Teoria da Relatividade: o Universo a 4 Dimensões" at Clube Gandaia - Conferências da Universidade Popular da Gandaia, Almada, Portugal, February 12, 2019.

**Jorge Drumond Silva** gave the talk "A Matemática da Física", in the meeting Matemática no Técnico: Vem conhecer as melhores profissões do mundo... in July.

**Patricia Gonçalves** gave the talk "Ice particles, coffee ring effects, propagation of fires and the Tetris game: what is their mathematical relationship?" at the Academia de Verão do IST, July 2019.

**Filipe Mena** co-organised the Portuguese Mathematical Society Summer School 2019, Escola D. Filipa de Lencastre, Lisbon, July 2-5.

**Margarida Mendes Lopes** wrote the article "Birkar e o programa do modelo minimal", Revista Ponto Fixo, nº1, 2019, NMATH, IST.

**José Natário** gave the talk *Perguntas de Matemática* at the IST Summer Academy, for 5-8th grade students, July 2018.

**Fernando Pestana da Costa** lectured an MSc course on Differential Equations in the AIMS South Africa Structured Masters Programme, African Institute for Mathematical Sciences, Muizenberg, Cape Town, South Africa (November 2019).

**Fernando Pestana da Costa** lectured a short course on Coagulation-Fragmentation Models, in the "West Asia Mathematical School on Recent Developments and Applications of Partial Differential Equations, from Theory to Simulation", at the Indian Institute of Technology Roorkee, Roorkee, India (August 29 – September 3, 2019).

**Fernando Pestana da Costa** received a grant from the International Science Programme, Uppsala University, Uppsala, Sweden, to lecture a free course on "Asymptotic Methods for Integrals and Applications at the Department of Mathematics", Faculty of Natural Sciences, National University of Laos, Vientiane, Laos (January 30 – February 16, 2019).

**Fernando Pestana da Costa** lectured a short course with the title "An Introduction to Weak Convergence Techniques in Coagulation Equations", in the Department of Mathematics, Indian Institute of Technology Roorkee, Roorkee, India (January 22 – 25, 2019).

**Fernando Pestana da Costa** lectured a short course on Asymptotic Methods for Integrals, at the Research Workshop "Theory and Simulation of Hyperbolic PDEs arising in Mathematical Biology and Fluid Flow", Indo-French Center for Applied Mathematics, Birla Institute of Technology and Science, Pilani, India (January 5 – 11, 2019).

**Roger Picken** gave in June a presentation and practical session about rational tangles for a group of Portuguese and French school students at Colégio S. João de Brito, Lumiar. This was in the context of a school maths research project, "Projecto Desafios", led by Diogo Veloso, modelled on the French project MATh.en.JEANS

**João Pimentel Nunes** wrote the article "Geometria em Tempo Imaginário", Revista Ponto Fixo, nº1, 2019, NMATH, IST.

**João Pimentel Nunes** gave the talk "O que acontece quando os matemáticos tentam pentear uma esfera?", Tardes de Matemática da SPM, FNAC do Colombo, February de 2019.

**João Pimentel Nunes** gave the talk O Teorema da Bola Cabeluda" at the Academia de Verão do IST, July 2019.

**Ricardo Schiappa** talked in the Antena 1 program "90 seconds of science".

# 11 Personal notes

**Sílvia Anjos**, acting as a member of the ESF (European Science Foundation) College of Expert Reviewers, was in the evaluation committee of the Research Foundation Flanders (FWO) Call for Junior and Senior postdoctoral Fellowships.

**Leonardo di Carlo** was a Visiting Scientist at the Dipartimento di Matematica, Università di L'Aquila, Italy, in November 8 – December 23, 2019.

**Chiara Franceschini** and **Patrícia Gonçalves** interviewed the Field Medalist Martin Hairer for the CIM Bulletin in December 2019.

**Patrícia Gonçalves** is is a member of the Scientific Council of IST.

**Gabriel Lopes Cardoso**, extended stay at Albert Einstein Institute, Golm, Germany, May 31 –June 14, 2019.

**Fernando Pestana da Costa** became full professor of Universidade Aberta in July 2019.

**Fernando Pestana da Costa** is vice-president of the Scientific Council of Universidade Aberta.

**Fernando Pestana da Costa** is first secretary of the General Assembly of the Portuguese Mathematical Society.

**Filipe Mena** was member of the scientific committee of the meetings "XII Black Hole Workshop" and "Portuguese Mathematical Society Summer School 2019".

**Filipe Mena** is co-organizer of the Diagonal Seminars at DM-IST.

**Filipe Mena** was evaluator of project applications to the Czech Science Foundation.

**Margarida Mendes Lopes** was member of the Scientific Committee of the workshop "WM2 - Women in Mathematics Meeting", Universidade Nova de Lisboa, 22-24 July 2019.

**Margarida Mendes Lopes** organised the panel discussion: "Math Gender Gap" during the workshop WM2 - Women in Mathematics Meeting, Universidade Nova de Lisboa, 22-24 July 2019.

**Roger Picken** was a member of the Scientific Committee of the XXVIII International Fall Workshop on Geometry and Physics, ICMAT, Madrid, Spain, September 2-6, 2019.

**Carlos Rocha** was a member of the Scientific Committee of the International Conference Progress on Difference Equations - PODE 2019, in honor of Professor David Rand, Instituto Politécnico de Bragança, May 27-30, 2019, Bragança, Portugal.

**Ricardo Schiappa** visited CERN (Geneva, Switzerland) in January–March.

**Ricardo Schiappa** was an evaluator and expert for the Marie-Curie Individual-Fellowships 2019 of the European Commission H2020 Programme H2020-MSCA-IF-2019 (String Theory, Mathematical Physics).

**Ricardo Schiappa** was an invited key participant of the 2019 CERN TH-Institute on Topological String Theory & Related Topics (Geneva, Switzerland) and invited speaker for the associated Colloquium.

**Ricardo Schiappa** co-organized the Graduate Mini Course on Resurgence in Mathematics and Physics, Beijing CNU.

**Juha Videman** was member of the Scientific Committee of the MARINE 2019 – VIII International ECCOMAS Conference on Computational Methods in Marine Engineering, Göteborg, Sweden, May 13–15, 2019.