



Instituto Superior Técnico



Center for Mathematical Analysis,
Geometry, and Dynamical Systems

Report 2022

June 2023

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1 Research Projects and Special Grants

The following projects were coordinated by CAMGSD members in 2022:

Black holes, holography and phase transitions

(Started: September 7, 2020, duration: 24 months)

Funding agency: Fundação para a Ciência e a Tecnologia and CERN

Reference: CERN/FIS-PAR/0023/2019

Principal investigator: Filipe Moura (ISCTE and IT)

Co-Principal investigator: João Costa (CAMGSD)

Number of CAMGSD participants: 2

The project is organized into two tasks. In the first task we will deal with black hole perturbations, quasinormal modes and cosmic censorship. In these studies we will be concerned with the effects of higher derivative corrections in the black hole solutions we will consider. These corrections are typically motivated by string theories. In the second task we will apply the AdS/CFT correspondence to problems of current interest in strongly coupled systems, namely condensed matter and nonperturbative QCD.

Categorification, quantization and knots

(Started: November 2, 2021, duration: 6 years)

Funding agency: Fundação para a Ciência e a Tecnologia

Reference: 2020.02453.CEECIND. FCT CEEC Individual Program

Research contract level: Principal researcher

Researcher: Marko Stošić

This project focuses on the interplay between homological knot invariants, Donaldson-Thomas invariants of quivers, quantum groups and their categorifications, as well as relationships with string theory. The main goal of this project is to study the knots-quivers correspondence and its implications. In particular, the plan is to determine precisely its origin, by finding the intrinsic definition of the correspondence, and to determine precisely how the categorification of knot invariants and quantization process of A-polynomials enter in this correspondence.

General spectral theory for fully nonlinear elliptic systems of PDEs with coupling power-like nonlinearities and related problems

(Started: November, 2021, duration: 6 years)

Funding agency: Fundação para a Ciência e a Tecnologia

Reference: CEECIND/CP1587/CT0008, FCT Junior Researcher

Researcher: Delia Schiera

The main objective of this research project is to study the eigenvalue problem for elliptic systems of PDEs of Lane Emden type with nonlinear operators as general as possible. As a final goal, it is our purpose to build a robust eigen-theory for such systems, which could unveil the complex relationship existing among spectral curves of eigenvalues, maximum principles and existence of positive super solutions. Related problems, for instance extension to higher order or fractional operators, will also be investigated.

Geometrical and Algebraic Structures on the Space of Quantum Theories

(Started: October 1, 2018, duration: 3 + 1 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. 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.

Higher Structures and Applications

(Started: July 1, 2018, duration: 3 + 1 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 + 2 years)

Funding agency: European Research Council - Starting Grant

Contract number: 715734

Principal investigator: Patrícia 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.

Langlands duality and Quantization within the moduli of Higgs bundles on elliptic curves

(Started: June 1, 2019, duration: 3 1/4 years)

Funding agency: Fundação para a Ciência e a Tecnologia

Reference: CEECIND/04153/2017, FCT Investigator Program

Researcher: Emílio Franco

This research project focuses on the interplay of two approaches to quantization, the so-called Geometric Quantization, which has been widely studied, and the less known Brane Quantization, proposed by Gukov and Witten. The second approach is conceptually rich, although requires highly non-trivial computations. Nevertheless, there are occasions where these computations can be avoided by means of Mirror Symmetry and Langlands duality, as is the case of the Hitchin system over elliptic curves. We propose to study both of these approaches to quantization.

Nonlinear Dispersive and Elliptic Systems - new horizons in regularity, dynamics and asymptotic analysis

(Started: March 1, 2021, duration: 3 years)

Funding agency: Fundação para a Ciência e a Tecnologia

Reference: PTDC/MAT-PUR/1788/2020

Principal Investigator: Hugo Tavares

Number of CAMGSD participants: 3

This project addresses key contemporary questions in Partial Differential Equations (PDEs), focusing on several nonlinear problems which appear at the intersection of the dispersive and elliptic worlds and which require a multidisciplinary approach.

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

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.

Spaces of embeddings, Galois symmetries and Dwyer's conjecture

(Started: November, 2022, duration: 6 years)

Funding agency: Fundação para a Ciência e a Tecnologia

Reference: 2021.01497.CEECIND, FCT Auxiliary Researcher

Researcher: Pedro Boavida de Brito

This project explores the homotopy and homology of spaces of smooth and topological embeddings, especially concerning torsion, using homotopy theoretical methods. At the core of the approach is a connection between embedding spaces and the little disks operad, and certain highly non-trivial Galois symmetries that were recently discovered.

Strong Cosmic Censorship Conjecture or how singular are dynamical Einstein spacetimes

(Started: September, 2020, duration: 2 years)

Funding agency: Fundação para a Ciência e a Tecnologia

Reference: CEECIND/00936/2018, FCT Junior Researcher

Researcher: Anne Franzen

This project is motivated by the aim to establish valid versions of the Strong Cosmic Censorship Conjecture for particular wave models. Step by step I wish to investigate related, but slightly distinct models, so that the culmination of the results can eventually lead to a more general statement of the Strong Cosmic Censorship Conjecture for astrophysically relevant spacetimes.

Symplectic Geometry and Conservative Dynamics

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

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.

Universality classes for fluctuations and boundary phenomena in driven diffusive systems

(Started: November 1, 2021, duration: 6 years)

Funding agency: Fundação para a Ciência e a Tecnologia

Reference: 2020.03953.CEECIND, FCT CEEC Individual Program

Research contract level: Principal researcher

Researcher: Gunter Markus Schuetz

This project focusses the on universal features of the large-scale dynamics of stochastic interacting particle systems. The main goal is the derivation of hydrodynamic partial differential equations for the large scale dynamics of the conserved fields such as mass distributions - from the laws of microscopic interactions in lattice models and to refine mode coupling theory and duality to study universal fluctuations and boundary effects. In particular, it is planned to characterize the dynamical phase diagram of weakly driven systems, the properties of the Kardar-Parisi-Zhang universality class in the presence of coupling to a diffusive mode, the derivation of corrections to scaling in the universal dynamical structure function, and the characterization of boundary-induced phase transitions in open systems by means of appropriate boundary conditions for the macroscopic hydrodynamic equations.

2 Visitors

The following researchers visited the Center in 2022:

February

Marek Ptak (University of Agriculture in Krakow)

March

Christoph Thiele (Rheinische Friedrich Wilhelms Universität, Bonn)

Anastasiia Panchuk (Institute of Mathematics NAS of Ukraine)

April

Marco Morandotti (Politecnico di Milano)

Levi Lopes de Lima (Universidade Federal do Ceará)

May

Jarek Kedra (University of Aberdeen)

Joris Roos (University of Massachusetts Lowell)

Angela Pistoia (Università di Roma Sapienza)

Brian Williams (University of Edinburgh)

Ingmar Saberi (LMU München)

Andreas Minne (KTH Royal Institute of Technology)

Nezhla Aghaei (Université de Genève)

Luccas Campos (Universidade Federal de Minas Gerais)

Rainer Mandel (Karlsruhe Institute of Technology)

Clement Erignoux (Laboratoire Paul Painlevé INRIA)

June

Aleksandar Milivojevic (Max Planck Institute Bonn)

Michael Albanese (University of Waterloo)

João Pedro Ramos (ETH Zürich)

Luís Diogo (Uppsala University)

Du Pei (Harvard University)

Sergiy Mozgovyy (Trinity College Dublin)

Jonathan Partington (University of Leeds)

Mirko Mauri (University of Michigan)
Rachid El Harti (University of Hassan I)
Valeria Ricci (Universtà degli Studi de Palermo)
Laurent Desvilletes (Université Paris Diderot)
Raffaele Esposito (Università degli Studi Dell' Aquila)
Ben Davison (University of Edinburgh)
Lino Amorim (Kansas State University)
Xenia de la Ossa (Oxford University)
Emanuele Dolera (Università di Pavia)
Ester Gabetta (Università di Pavia)
Cedric Bernardin (Université Côte d'Azur)
Hugo da Cunha (ENS Lyon)
Conrado Costa (Durham University)

July

Manuel del Pino (University of Bath)
Elvira Zappale (Università di Roma Sapienza)
Denis Bonheure (Université libre de Bruxelles)
Gianmaria Verzini (Politecnico di Milano)
Isabeau Birindelli (Università di Roma Sapienza)
Nicholas Lindsay (Universität zu Köln)
José Carrillo de la Plata (University of Oxford)
Martin Pinsonnault (Western University)
Lu Xu (Gran Sasso Science Institute)

August

Radoslaw Czaja (University of Silesia in Katowice)
Giorgio Fusco (Università di Padova)

September

Glaucio Terra (Universidade de São Paulo)
Ronaldo Garcia (Universidade Federal de Goiás)
Anibal Rodriguez Bernal (Universidad Complutense Madrid)
Clodoaldo Ragazzo (Universidade de São Paulo)

Nicholas Alikakos (University of Athens)
Bernold Fiedler (Freie Universität Berlin)
Sérgio Oliva (Universidade de São Paulo)
Jaime Angulo Pava (Universidade de São Paulo)
Jose Arrieta (Universidad Complutense Madrid)
Paolo Piccione (Universidade de São Paulo)
Fábio Tal (Universidade de São Paulo)
Edson de Faria (Universidade de São Paulo)
António Galves (Universidade de São Paulo)
Alexandre Carvalho (Universidade de São Paulo)
Rui Loja Fernandes (University of Illinois Urbana-Champaign)
Vishnu Jejjala (University of the Witwatersrand)
David Krejcirik (Czech Technical University)
Claes Ugglä (Karlstads universitet)
Leandro Medeiros (Utrecht University)
Dimitrios Tsakargiannis (University of Crete)

October

Montse Corbera (Universitat Central de Catalunya)
Ana Ferreira (Universidade do Minho)
Diogo Gomes (KAUST)
José Miguel Urbano (KAUST)

November

Sarah Petersen (University of Notre Dame)
Roman Hric (Univerzity Mateja Bela)

November

Jaume Llibre (Universitat Autònoma de Barcelona)

3 Seminar Series and Working Seminars

3.1 Algebra

Jun 07

Rachid El Harti. *Université Hassan I, Morocco.* On subalgebras of crossed product Banach algebras.

Jun 07

Manpreet Singh. *CAMGSD.* Some properties of link quandles.

Nov 10

Sarah Petersen. *MPIM Bonn.* The $RO(C_2)$ -graded homology of C_2 -equivariant Eilenberg-MacLane spaces.

3.2 Analysis, Geometry, and Dynamical Systems

Feb 04

Gabriel Nahum. *Instituto Superior Técnico.* An interacting particle system interpolating the Symmetric Simple Exclusion Process and the Porous Media Model.

Feb 08

Mate Garencser. *TU Wien.* Boundary renormalisation of stochastic PDEs.

Feb 11

Pedro Cardoso. *Instituto Superior Técnico.* Hydrodynamic behavior of long-range symmetric exclusion process with a slow barrier.

Mar 15

Marielle Simon. *INRIA-Lille France.* One-dimensional chain of oscillators with random flips of velocities.

Mar 15

Marielle Simon. *INRIA-Lille France.* One-dimensional chain of oscillators with random flips of velocities.

Mar 16

Marielle Simon. *INRIA-Lille France.* One-dimensional chain of oscillators with random flips of velocities.

Apr 05

Marco Morandotti. *Politecnico di Torino.* Minimisers of the Canham-Helfrich functional in the space of generalised Gauss graphs.

May 02

Clément Erignoux. *INRIA Lille.* Varadhan's non-gradient method for diffusive hydrodynamic limits.

May 03

Clément Erignoux. *INRIA Lille.* Varadhan's non-gradient method for diffusive hydrodynamic limits.

May 05

Clément Erignoux. *INRIA Lille.* Varadhan's non-gradient method for diffusive hydrodynamic limits.

May 06

Clément Erignoux. *INRIA Lille.* Varadhan's non-gradient method for diffusive hydrodynamic limits.

May 24

Yingfei Yi. *University of Alberta.* Response solutions in degenerate, quasi-periodically forced nonlinear oscillators.

Jun 09

Conrado Costa. *Durham University.* Stochastic Billiards with Markovian reflection in generalized parabolic domains.

Jul 11

Gunter Schuetz. *CAMGSD.* Mode coupling theory for nonlinear fluctuating hydrodynamics.

Jul 12

Gunter Schuetz. *CAMGSD.* Mode coupling theory for nonlinear fluctuating hydrodynamics.

Jul 14

Gunter Schuetz. *CAMGSD.* Mode coupling theory for nonlinear fluctuating hydrodynamics.

Jul 15

Gunter Schuetz. *CAMGSD.* Mode coupling theory for nonlinear fluctuating hydrodynamics.

Jul 20

Lu Xu. *Inria Lille.* Hydrodynamic limit for asymmetric simple exclusion with open boundaries.

Jul 21

Lu Xu. *Inria Lille.* Hydrodynamic limit for asymmetric simple exclusion with open boundaries.

Jul 22

Lu Xu. *Inria Lille.* Hydrodynamic limit for asymmetric simple exclusion with open boundaries.

Sep 30

Leandro Chiarini. *Universidade de Utrecht.* Stochastic homogenisation of Gaussian fields.

Nov 30

João Pereira. *Instituto de Matemática Pura e Aplicada.* Method of Moments: From Sample Complexity to Efficient Implicit Computations.

3.3 Geometria em Lisboa

Jan 11

Lars Sektnan. *University of Gothenburg.* Blowing up extremal Kähler manifolds.

Jan 18

Hossein Movasati. *Instituto Nacional de Matemática Pura e Aplicada.* A quest for new theories of automorphic forms: Gauss-Manin connection in disguise.

Jan 25

Giancarlo Urzua. *Pontificia Universidad Catolica de Chile.* What is the right combinatorics for spheres in K3 surfaces?

Feb 01

Johannes Horn. *Universität Frankfurt.* Resolving the rank 2 Hitchin system by compactified Jacobians of semi-stable curves.

Feb 08

Jonny Evans. *University of Lancaster.* Symplectic cohomology of compound Du Val singularities.

Feb 15

Richard Hind. *University of Notre Dame.* The Gromov width of Lagrangian complements.

Feb 22

Louis Ioos. *Max Planck Institute for Mathematics (Bonn).* Berezin-Toeplitz quantization in the Yau-Tian-Donaldson program.

Mar 08

Ana Peán-Nieto. *University of Birmingham.* Higher wobbly bundles.

Mar 15

Joel Fine. *Université Libre de Bruxelles.* Knots, minimal surfaces and J-holomorphic curves.

Mar 22

Yang Zhou. *Shanghai Center for Mathematical Sciences, Fudan University.* Quasimap wall-crossing in enumerative geometry.

Mar 29

Jun Li. *University of Michigan-Ann Arbor.* Stability and isotopy of symplectomorphism groups of ruled surfaces.

Apr 05

Christian Pauly. *Université de Nice Sophia-Antipolis.* On very stable bundles.

Apr 12

Michael R. Douglas. *Simons Center for Geometry and Physics.* Holomorphic feedforward networks.

Apr 19

Miguel Pereira. *University of Augsburg.* The Lagrangian capacity of toric domains.

Apr 26

Lucas Ambrozio. *Instituto de Matemática Pura e Aplicada.* Analogues of Zoll surfaces in minimal surface theory.

May 10

Miguel Abreu. *CAMGSD-IST.* Contact invariants of Q-Gorenstein toric contact manifolds and the Ehrhart (quasi-) polynomials of their toric diagrams.

May 13

Herwig Hauser. *Universität Wien.* The ideas of Lazarus Fuchs concerning ordinary differential equations.

May 17

Vincent Humilière. *Institut de Mathématiques de Jussieu - Paris Rive Gauche.* Groups of area preserving homeomorphisms and their simplicity.

May 24

Gleb Smirnov. *University of Geneva.* Symplectic mapping class groups of K3 surfaces and gauge theory.

May 25

Sean Paul. *University of Wisconsin Madison.* The Yau-Tian-Donaldson conjecture for general polarized manifolds with finite automorphism group.

May 25

Sean Paul. *University of Wisconsin Madison.* The Yau-Tian-Donaldson conjecture for general polarized manifolds with finite automorphism group. Part II.

May 31

Inder Kaur. *Goethe University Frankfurt am Main.* Birational geometry of blow-ups of projective spaces.

Jun 07

Vinicius Ramos. *Instituto de Matemática Pura e Aplicada.* The Toda lattice and the Viterbo conjecture.

Jun 14

Michael Albanese. *Université du Québec a Montréal.* The Yamabe Invariant of Complex Surfaces.

Jun 21

Aleksandar Milivojevic. *Max Planck Institute for Mathematics - Bonn.* Holomorphic notions of formality and Massey products.

Jul 05

Bruno de Oliveira. *University of Miami.* A_n singularities and bigness of the cotangent bundle.

Sep 16

Alexander Givental. *University of Berkeley.* K-theoretic Gromov-Witten invariants and their adelic characterization.

Sep 27

Lino Amorim. *Kansas State University.* From categories to Gromov-Witten invariants.

Oct 04

Gustavo Granja. *CAMGSD-IST.* Topology of almost complex structures.

Oct 11

Antonella Grassi. *Università di Bologna* A family of threefolds with several unusual features.

Oct 18

Miguel Moreira. *ETH Zurich.* Virasoro constraints in sheaf theory.

Nov 08

Simon Jubert. *Université du Québec a Montréal.* A Yau-Tian-Donaldson correspondence on a class of toric fibration.

Nov 15

Matias del Hoyo. *Universidade Federal Fluminense.* Completeness of metrics and linearization of Lie groupoids.

Nov 22

João Pimentel Nunes. *CAMGSD-IST.* The geometric interpretation of the Peter-Weyl theorem.

Nov 29

Sobhan Seyfaddini. *Institut de Mathématiques de Jussieu - Paris Rive Gauche.* On the algebraic structure of groups of area-preserving homeomorphisms.

Dec 06

Sofia Tirabassi. *Stockholm University.* Characterization of quasi-abelian surfaces.

Dec 13

Nicki Magill. *Cornell University.* Symplectic embeddings of Hirzebruch surfaces.

Dec 20

Luís Diogo. *Uppsala University.* Lagrangian tori in the cotangent bundle of the 2-sphere.

3.4 Lisbon WADE – Webinar in Analysis and Differential Equations

Mar 04

Shobu Shiraki. *Saitama University.* Variants of Carleson’s problem for the solution to Schrödinger equations.

Mar 31

Jaqueline Mesquita. *Universidade de Brasília.* Linearized instability for neutral FDEs with state-dependent delays.

Apr 06

Wladimir Neves. *Universidade Federal do Rio de Janeiro.* Solvability of the Fractional Hyperbolic Keller-Segel System.

Apr 07

Diego Moreira. *Universidade Federal do Ceará.* Semiconvex Supersolutions to Fully Nonlinear PDEs.

Apr 20

Jean Van Schaftingen. *Université Catholique de Louvain.* Ginzburg-Landau functionals on planar domains for a general compact vacuum manifold.

May 04

Delia Schiera. *CAMGSD-IST.* Positive solutions to a nonlinear Choquard equation with symmetry.

May 11

Angela Pistoia. *Università di Roma La Sapienza.* Segregated solutions for some nonlinear Schrödinger systems.

May 18

Joris Roos. *University of Edinburgh.* Spherical maximal functions and fractal dimensions of dilation sets.

May 25

Alberto Saldaña. *Universidad Nacional Autónoma de México.* An introduction to the logarithmic Laplacian: what it is and what are some of its applications.

Jun 01

Rainer Mandel. *Karlsruher Institut für Technologie.* New Gagliardo-Nirenberg inequalities and applications to biharmonic NLS.

Jun 08

Luccas Campos. *Universidade Federal de Minas Gerais.* The role of the inhomogeneity on non-radial scattering for nonlinear Schrödinger equations.

Jun 15

João Pedro Ramos. *ETH Zurich.* Time-frequency localisation operators, their eigenvalues and relationship to elliptic PDE.

Jun 17

Sergei Kuksin. *Université Paris VII.* Kolmogorov theory of turbulence and a rigorous theory of one-dimensional turbulence.

Jun 28

Daniel Marroquin. *Universidade Federal do Rio de Janeiro.* Stochastic two-scale Young measures and homogenization of conservation laws with multiplicative noise.

Jun 29

Hermano Frid. *Instituto de Matemática Pura e Aplicada.* On short wave-long wave interactions in the relativist context.

Jul 21

Jürg Wolf. *Department of Mathematics, Chung-Ang University, Seoul.* Existence of weak solutions the equations of a non-Newtonian fluid with non standard growth.

Sep 13

Jonathan Bennett. *University of Birmingham.* The nonlinear Brascamp-Lieb inequality and applications.

Nov 10

Damião Araújo. *Universidade Federal da Paraíba.* On highly degenerate Alt-Phillips problems.

Nov 17

Giuseppe Negro. *CAMGSD-IST.* Explicit solutions to the cubic wave equation.

Dec 15

Ederson Moreira dos Santos. *ICMC, Universidade de São Paulo em São Carlos.* On Hamiltonian systems with critical Sobolev exponents.

3.5 Mathematical Relativity

Feb 03

Eric Ling. *Rutgers University.* On the discrete Dirac spectrum of a point electron in the zero-gravity Kerr-Newman spacetime.

Mar 03

Zoe Wyatt. *Cambridge University.* Global Stability of Spacetimes with Supersymmetric Compactifications.

Apr 07

Robert Wald. *University of Chicago.* The Memory Effect and Infrared Divergences.

Apr 28

Giuseppe Negro. *Instituto Superior Técnico.* Sharp Strichartz estimates for the wave equation via the Penrose compactification.

May 05

Levi Lima. *Universidade Federal do Ceará.* Rigidity of non-compact static domains in hyperbolic space via a positive mass theorem.

Jun 02

Jim Isenberg. *University of Oregon.* Stability of AVTD Behavior for Polarized T^2 -Symmetric Space-Times.

Jun 23

Edgar Gasperin. *Instituto Superior Técnico.* The conformal Killing spinor initial data equations.

Jul 04

Moritz Reintjes. *City University of Hong Kong.* On the regularity implied by the assumptions of geometry.

Jul 07

Thomas Körber. *University of Vienna.* Uniqueness of large area-constrained Willmore spheres in initial data sets.

Sep 01

Badri Krishnan. *Radboud University.* A quasi-local view of black hole mergers.

Oct 06

Marcus Khuri. *Stony Brook University.* Level Set Methods in Mathematical GR.

Nov 03

José Natário. *CAMGSD-IST.* Relativistic elasticity and compactness bounds.

Dec 01

Elena Giorgi. *Columbia University.* Physical-space estimates on black hole perturbations.

3.6 Mathematics, Physics & Machine Learning

Jan 13

Dan Roberts. *MIT, Center for Theoretical Physics.* The Principles of Deep Learning Theory.

Jan 20

Anders Hansen. *Faculty of Mathematics and Department of Applied Mathematics and Theoretical Physics, University of Cambridge.* Why things don't work – On the extended Smale's 9th and 18th problems (the limits of AI) and methodological barriers.

Feb 03

Joosep Pata. *National Institute of Chemical Physics and Biophysics, Estonia.* Machine learning for data reconstruction at the LHC.

Feb 24

André F. T. Martins. *Instituto Superior Técnico.* From Sparse Modeling to Sparse Communication.

Mar 03

Jan Kieseler. *European Organization for Nuclear Research (CERN).* The MODE project.

Mar 24

Fernando E. Rosas. *Faculty of Medicine, Department of Brain Sciences, Imperial College.* Towards a deeper understanding of high-order interdependencies in complex systems.

Mar 31

Josef Urban. *Czech Institute of Informatics, Robotics and Cybernetics.* Machine Learning and Theorem Proving.

Apr 14

Dmitry Krotov. *MIT-IBM Watson AI Lab and IBM Research in Cambridge.* Modern Hopfield Networks in AI and Neurobiology.

Apr 21

Rianne van den Berg. *Microsoft Research Amsterdam.* Generative models for discrete random variables.

Apr 28

Emtiyaz Khan. *RIKEN-AIP, Tokyo and OIST, Okinawa, Japan.* The Bayesian Learning Rule for Adaptive AI.

May 05

Andrea L. Bertozzi. *University of California Los Angeles.* Graph based models in semi-supervised and unsupervised learning.

May 19

Stanley Osher. *Department of Mathematics, University of California, Los Angeles.* Conservation laws and generalized optimal transport.

May 26

Yongji Wang. *Department of Geosciences, Princeton University.* Physics-informed neural networks for solving 3-D Euler equation.

Jun 02

Anja Butter. *ITP, University of Heidelberg.* Machine Learning and LHC Event Generation.

Jun 16

John Baez. *U.C. Riverside.* Shannon Entropy from Category Theory.

Jun 30

Dario Izzo. *European Space Agency.* Geodesy of irregular small bodies via neural density fields: geodesyNets.

Jul 07

Audrey Durand. *IID, Université Laval, Canada.* Interactive learning for Neurosciences - Between Simulation and Reality.

Jul 14

Joseph Bakarji. *University of Washington.* Dimensionally Consistent Learning with Buckingham Pi.

Jul 21

Paulo Tabuada. *University of California, Los Angeles.* Deep neural networks, universal approximation, and geometric control.

Sep 08

Inês Hipólito. *Humboldt-Universität.* The Free Energy Principle in the Edge of Chaos.

Sep 29

Petar Velickovic. *DeepMind and University of Cambridge.* Geometric Deep Learning: Grids, Graphs, Groups, Geodesics and Gauges.

Oct 14

Diogo Gomes. *KAUST.* From Calculus of Variations to Reinforcement Learning.

Oct 14

Diogo Gomes. *KAUST.* From Calculus of Variations to Reinforcement Learning.

Oct 14

José Miguel Urbano. *KAUST.* Semi-Supervised Learning and the ∞ -Laplacian.

Oct 14

José Miguel Urbano. *KAUST.* Semi-Supervised Learning and the ∞ -Laplacian.

Oct 27

Robert Nowak. *University of Wisconsin-Madison.* The Neural Balance Theorem and its Consequences.

Nov 03

Frederico Fiuza. *SLAC.* Accelerating the understanding of nonlinear dynamical systems using machine learning.

Nov 10

João Sacramento. *ETH Zurich.* The least-control principle for learning at equilibrium.

Nov 17

Tom Goldstein. *University of Maryland.* Building (and breaking) neural networks that think fast and slow.

Nov 24

Markus Reichstein. *MPI for Biogeochemistry.* Integrating Machine Learning with System Modelling and Observations for a better understanding of the Earth System.

Dec 15

Bruno Loureiro. *Ecole Polytechnique Federale de Lausanne (EPFL).* Phase diagram of Stochastic Gradient Descent in high-dimensional two-layer neural networks.

3.7 Partial Differential Equations

Feb 09

Benedetta Pellaci. *Università degli Studi della Campania "Luigi Vanvitelli"* Qualitative properties of the optimizers of the principal eigenvalue in indefinite weighted Neumann problems: A singular analysis.

Feb 09

Giovanni Pisante. *Università degli Studi della Campania "Luigi Vanvitelli"* A journey with Differential Inclusions: how to find solutions, advantages and disadvantages.

May 13

Andreas Minne. *KTH Royal Institute of Technology.* A New Notion of Laplacian in Metric Measure Spaces.

Nov 10

Vincenzo Bianca. *Universidade de Coimbra.* Diffusion processes in heterogeneous media.

3.8 Probability and Stochastic Analysis

Jan 05

Makiko Sasada. *University of Tokyo.* On Varadhan's decomposition theorem in a general setting.

Jan 12

Davide Gabrielli. *University of L'Aquila.* A double limite for the current of particle systems. The order does not matter.

Jan 19

Amine Asselah. *Paris-Est Créteil.* Intersection of the traces of two independent walks in high dimensions.

Jan 26

Daniel Contreras. *ETH Zurich.* Supercritical percolation on graphs of polynomial growth.

Feb 02

Oriane Blondel. *Université Claude Bernard Lyon 1.* Kinetically constrained models out of equilibrium.

Feb 09

Sunder Serthuraman. *University of Arizona.* Condensation, boundary conditions, and effects of a slow site in zero-range systems.

Feb 16

Marcelo Hilario. *Universidade Federal de Minas Gerais.* Percolation on the cubic lattice with lower dimensional disorder.

Feb 23

Krzysztof Burdzy. *University of Washington.* From billiards to PDEs via white noise.

Mar 02

Perla Sousi. *University of Cambridge.* Phase transition for the late points of random walk.

Mar 09

Fraydoun Rezakhanlou. *UC Berkeley.* Markovian solutions for scalar conservation laws.

Mar 16

Guillaume Barraquand. *ENS Paris.* Invariant measures for the KPZ equation.

Mar 23

Sourav Chatterjee. *Stanford University.* Local KPZ behavior under arbitrary scaling limits.

Mar 30

Jeremy Quastel. *University of Toronto.* Integrable fluctuations in 1+1 dimensional random growth.

Apr 06

Elena Pulvirenti. *TU Delft.* Metastability for the dilute Curie-Weiss model with Glauber dynamics.

Apr 13

Li-Cheng Tsai. *Rutgers University.* Hydrodynamic large deviations of strongly asymmetric interacting particle systems.

Apr 20

Cédric Bernardin. *Université de Nice.* Boundary driven lattice gas with long jumps.

Apr 27

Hubert Lacoïn. *Instituto de Matemática Pura e Aplicada.* Existence of solution and localization for the stochastic heat equation with multiplicative Lévy white noise.

May 04

Anna Ben-Hamou. *Sorbonne Université.* Cutoff for permuted Markov chains.

May 11

Chiranjib Mukherjee. *University of Muenster.* SPDEs, directed polymers and multiplicative chaos.

May 18

Lu Xu. *Inria, Lille.* Hydrodynamics for open ASEP with weak symmetry.

May 25

Ivailo Hartarsky. *CEREMADE, Paris Dauphine.* Two-dimensional universality in bootstrap percolation and kinetically constrained models.

Jun 01

Cristina Toninelli. *University Paris Dauphine - PSL.* Fredrickson-Andersen 2-spin facilitated model: sharp threshold.

Jun 08

Tuca Auffinger. *Northwestern University.* Parisi measures.

Jun 15

Christophe Bahadoran. *Université Blaise Pascal, Clermont-Ferrand.* Invariant measures for multilane exclusion process.

Jun 22

Daniel Valesin. *Warwick University.* Scaling limit of an adaptive contact process.

Jun 29

Augusto Teixeira. *Instituto de Matemática Pura e Aplicada.* Decoupling inequalities for cylinders' percolation.

Jul 06

Gaultier Lambert. *University of Zurich.* Normal approximation for traces of random unitary matrices.

Jul 13

Wlodek Bryc. *University of Cincinnati.* Fluctuations of the height function for open ASEP.

Aug 24

Pietro Caputo. *University Roma Tre.* Rapid mixing of Gibbs samplers: Coupling, Spectral Independence, and Entropy Factorizations.

Aug 31

Eric Cator. *Radboud Universiteit.* PNG model on the circle.

Sep 07

Alisa Knizel. *University of Chicago.* Stationary measure for the open KPZ equation:.

Sep 14

Wei-Kuo Chen. *University of Minnesota.* Computational perspective of local magnetization in the Sherrington-Kirkpatrick model.

Sep 21

Sep 28

Claudio Landim. *IMPA-Brasil.* Metastability from the point of view of large deviations.

Oct 05

Kohei Hayashi. *University of Tokyo, Japan.* Derivation of the KPZ equation from microscopic systems in a high temperature regime.

Oct 19

Gaëtan Cane. *Université d'Orléans.* Superdiffusion transition for a noisy harmonic chain subject to a magnetic field.

Oct 26

Dominik Schmid. *Bonn University.* Mixing times for the TASEP on the circle.

Nov 02

Ellen Saada. *Université de Paris.* Ergodicity of some dynamics of DNA sequences.

Nov 09

Nicolas Lanchier. *Arizona State University.* Consensus and discordance in the Axelrod model for the dynamics of cultures.

Nov 23

Thomas Mountford. *Ecole Polytechnique Federale de Lausanne.* Greedy cleaning of Poisson dust on French railway.

Nov 30

Leandro Pimentel. *UFRJ.* Integration by Parts and the KPZ Two-Point Function.

Dec 07

Simone Floreani. *University of Oxford.* Sub-diffusive behaviors emerging from exclusion processes.

Dec 14

Amirali Hannani. *KU Leuven.* A stochastic thermalization of the Discrete Nonlinear Schrödinger Equation.

3.9 String Theory

Jan 17

Kiril Hristov. *Sofia University.* 4d $N = 2$ supergravity observables from Nekrasov partition functions.

Jan 24

Marija Tomacevic. *University of Barcelona.* Holographic Complexity of Quantum Black Holes.

Feb 07

John Stout. *Harvard University.* Decoding Divergent Distances.

Feb 21

Bartek Czech. *Tsinghua University.* Holographic Cone of Average Entropies and Universality of Black Holes.

Mar 14

Scott Collier. *Princeton University.* Wormholes and Spectral Statistics in the Narain Ensemble.

Mar 21

Micha Berkooz. *Weizmann Institute of Science.* Going beyond ER=EPR in the SYK model.

Apr 11

Anna-Lena Weigel. *University of Wuerzburg.* Berry phases, wormholes and factorization in AdS/CFT.

Apr 18

Nejc Ceplak. *Université Paris Saclay.* Resolving Black-Hole Microstructure with New Momentum Carriers.

May 02

Andrew Svesko. *University College London.* Quasi-local energy and microcanonical entropy in two-dimensional nearly de Sitter gravity.

May 23

Manus Visser. *University of Geneva.* Microcanonical Action and the Entropy of Hawking Radiation.

Jun 06

Nava Gaddam. *University of Utrecht.* Modular Bootstrap for (0,4) SCFTs in two dimensions.

Jun 27

Stathis Vitouladitis. *University of Amsterdam.* One-dimensional Quantum Gravity and the Schwarzian theory.

Jul 11

Antony J. Speranza. *University of Illinois, Urbana-Champaign.* Complexity Equals Anything?

Oct 10

Jie-qiang Wu. *ITP Beijing.* Algebra of diffeomorphism invariant observables in Jackiw-Teitelboim gravity.

Oct 31

Timothy Hollowood. *Swansea University.* Is Hawking's Black Hole Information Loss Paradox Solved?

Nov 07

Monica Kang. *California Institute of Technology.* Nonperturbative gravity corrections to bulk reconstruction.

3.10 Topological Quantum Field Theory

Jan 19

Giorgio Trentinaglia. *CAMGSD-IST.* Simplicial vector bundles and representations up to homotopy.

Jan 26

Jeffrey C. Morton. *SUNY Buffalo State.* The Fock Pseudomonad: Groupoidifying Second Quantization.

Feb 02

Emily Cliff. *University of Sherbrooke.* Moduli spaces of principal 2-group bundles and a categorification of the Freed-Quinn line bundle.

Feb 16

Daniel Grady. *Texas Tech University.* Deformation classes of invertible field theories and the Freed-Hopkins conjecture.

Mar 09

Manuel Araújo. *CAMGSD-IST.* String diagrams for higher categories.

Mar 16

Christoph Dorn. *University of Oxford.* Manifold diagrams: Poincaré duality, singularities, and smooth structures.

Mar 30

Dmitri Pavlov. *Texas Tech University.* The geometric cobordism hypothesis.

Apr 06

Yonatan Harpaz. *CNRS at University of Paris 13.* The cobordism hypothesis in dimension 1.

Apr 13

Ángel González Prieto. *Universidad Complutense de Madrid.* Topological Quantum Field Theories for Character Stacks.

Apr 27

Pavel Mnev. *University of Notre Dame.* On the Fukaya-Morse A_∞ category.

May 04

Jamie Vicary. *University of Cambridge.* Introducing homotopy.io: A proof assistant for geometrical higher category theory.

May 09

Nezhla Aghaei. *University of Southern Denmark.* Combinatorial quantisation of Supergroup Chern-Simons Theory.

May 17

Eugene Rabinovich. *University of Notre Dame.* Classical Bulk-Boundary Correspondences via Factorization Algebras.

May 25

Simone Noja. *University of Heidelberg.* The de Rham / Spencer double complex and the geometry of forms on supermanifolds.

Jun 01

Nima Moshayedi. *University of California, Berkeley.* Cutting-Gluing of TQFTs in the Symplectic Cohomological Formalism.

Jun 08

Álvaro del Pino Gómez. *Utrecht University.* h-Principles and applications to distributions.

Jun 15

Marc Lackenby. *University of Oxford.* Knot theory and machine learning.

Jun 29

Radmila Sazdanovic. *North Carolina State University.* Bilinear pairings on two-dimensional cobordisms and generalizations of the Deligne category.

Sep 14

Marina Logares. *Complutense University of Madrid.* Hitchin systems.

Sep 21

Pavel Safronov. *University of Edinburgh.* Skein modules and 4d TQFTs.

Oct 26

Marko Vojinovic. *University of Belgrade.* Insights into the Standard Model and quantum gravity from higher gauge theory.

Nov 16

Fiona Torzewska. *University of Leeds.* Topological quantum field theories and homotopy cobordisms.

Nov 30

Konrad Waldorf. *University of Greifswald.* A representation of the string 2-group.

Dec 07

Konstantin Eder. *University of Erlangen-Nürnberg.* Super Cartan geometry and (loop) quantum supergravity.

Dec 09

Zoran Petric. *Mathematical Institute SANU, Belgrade, Serbia.* A diagrammatic presentation of the category 3Cob .

4 Conferences and short courses

The following Conferences and Short Courses were organized or co-organized by members of the Center in 2022:

Workshop on Operator Theory, Complex Analysis, and Applications 2022 - WOTCA 2022

University of the Algarve, June 20-24, 2022

Organizers: Fernanda Botelho (University of Memphis, USA), Cristina Câmara (CAMGSD, IST), Cristina Diogo, (ISCTE-IUL and CAMGSD), Teresa Malheiro (CMAT, UMinho), Rui Marreiros (CEAFEL, Universidade do Algarve)

Young Researchers in Functional Analysis and Mathematical Physics '22

University of the Algarve, June 21-23, 2022

Organizers: Fernanda Botelho (University of Memphis, USA), Cristina Câmara (CAMGSD, IST), Cristina Diogo, (ISCTE-IUL and CAMGSD), Teresa Malheiro (CMAT, UMinho), Rui Marreiros (CEAFEL, Universidade do Algarve)

Workshop on Symplectic Dynamics

Instituto Superior Técnico, June 27 – July 1, 2022

Organizers: Miguel Abreu (CAMGSD, IST), Leonardo Macarini (CAMGSD, IST)

School on Mirror Symmetry and Moduli Spaces

Instituto Superior Técnico, June 27 – July 1, 2022

Organizers: Emilio Franco (CAMGSD, IST), Ana Peón-Nieto (Université Côte d’Azur and University of Birmingham), Tom Sutherland (FCUL, Universidade de Lisboa).

Three Nonlinear Days in Coimbra

University of Coimbra, July 13-15, 2022

Organizers: Edgard A. Pimentel (CMUC, Universidade de Coimbra), Hugo Tavares (CAMGSD, IST)

Workshop on BPS State Counting, Holography and Quantum Information

Online Event, August 31 – September 2, 2022

Organizers: Gabriel Lopes Cardoso (CAMGSD, IST), Suresh Nampuri (CAMGSD, IST).

8th IST-IME Meeting

Instituto Superior Técnico, September 5-9, 2022

Organizers: Miguel Abreu, Pedro Girão, Pedro Gonçalves Henriques, Luís Magalhães, João Palhoto Matos, José Matias, Henrique Oliveira, Carlos Rocha, Jorge Silva, Hugo Tavares (CAMGSD, IST)

5 Seminars given by members of the Center

The following seminar/webinar talks, invited lectures or short courses were given by members of the Center in 2022:

Pêdra Andrade, C^1 -regularity for degenerate fully nonlinear equations, LYMC2022 - Lisbon Young Mathematicians Conference, April 13, 2022.

Pêdra Andrade, Approximation methods for the parabolic normalized p-Laplacian, Celebrating Women in Mathematics, May 10, 2022.

Pêdra Andrade, Regularity theory for the parabolic normalized p-Laplace equation, Portugal-Italy Conference on Nonlinear Differential Equations and Applications (PICNDEA22), Universidade de Évora, July 07, 2022.

Pêdra Andrade, Regularity of solutions to a class of fully nonlinear degenerate elliptic equations, 8th Workshop on Analysis and PDEs, Universidade Federal de Sergipe, November 11, 2022.

Sílvia Anjos, Embeddings of symplectic balls into the projective plane, Brasil-Portugal joint Meeting in Mathematics, Universidade Federal da Bahia, Salvador-Bahia, Brasil, August, 14–20, 2022.

M. Cristina Câmara, Dual truncated Toeplitz operators and equivalence after extension, invited speaker, 28th International Conference in Operator Theory, West University of Timisoara, Timisoara, Romania, June 27 ,À July 1, 2022.

M. Cristina Câmara, A Riemann-Hilbert approach to Einstein field equations, invited talk, ENSPM 2022, Sessão de Física Matemática, Instituto Politécnico de Tomar, Portugal, July 18-20, 2022.

M. Cristina Câmara, General Toeplitz kernels and operator invariance, Semi-plenary talk, IWOTA 2022, Krakow, Poland, September 6-10, 2022.

M. Cristina Câmara, Dual band general Toeplitz operators, invited talk, Special Session on model spaces, their operators, and applications, IWOTA 2022, Krakow, Poland, September 6-10, 2022.

Simão Correia, The infinite normal form reduction for nonlinear dispersive equations, Analysis Seminar CIDMA, Aveiro, June 15, 2022.

Simão Correia, Stationary solutions to some Ginzburg-Landau equations, PICNDEA 2022, Évora, July 5, 2022.

- Simão Correia, Self-similar solutions and the modified Korteweg-de Vries equation, Workshop Three Nonlinear Days, Coimbra, July 13, 2022.
- Simão Correia, Stable perturbations of self-similar solutions for the modified KdV at the blow-up time, 8th IST-IME Meeting, Lisboa, September 6, 2022.
- Simão Correia, The modified Korteweg-de Vries flow around self-similar solutions: large-time asymptotics and blow-up stability, 5th Workshop on Nonlinear Dispersive Equations, Belo Horizonte, November 10, 2022.
- Simão Correia, A priori estimates for dispersive equations via frequency-restricted estimates, Basque Center for Applied Mathematics, Bilbao, December 15, 2022.
- Luís Filipe Costa, Frame-dragging: meaning, myths, and misconceptions, Spanish and Portuguese Relativity Meeting 2022 (EREP2022), Salamanca - Spain, 29 August - 2 September 2022
- Luís Filipe Costa, Frame-dragging: meaning, myths, and misconceptions, 23rd International Conference on General Relativity and Gravitation (GR23), Beijing - China, 3-8 July 2022
- Fernando P. da Costa, A coagulation type model for silicosis, Séminaire d'analyse appliquée A3, Université de Picardie Jules Verne, Amiens, France, May 9, 2022.
- Fernando P. da Costa, A coagulation type toy model for silicosis, 8th IST-IME Meeting, Instituto Superior Técnico, Lisboa, September 8, 2022
- Jorge Drumond Silva, Nonlinear smoothing by the infinite normal form reduction method, Analysis Seminar, CMUC, Universidade de Coimbra, July 22, 2022.
- Jorge Drumond Silva, Nonlinear smoothing by the infinite normal form reduction method, 8th IST-IME meeting, in honor of Giorgio Fusco, Técnico, Lisboa, September 9, 2022.
- Patrícia Gonçalves, Scaling limits for particle exchange models with several conservation laws, Recent Developments in Stochastic Duality, Eindhoven, The Netherlands, December, 2022.
- Patrícia Gonçalves, An overview on hydrodynamic limits, fluctuations and universality of interacting particle systems, IMPA 70 anos, October, 2022.

- Patrícia Gonçalves, On hydrodynamic limits of fractional PDEs from stochastic interacting particle systems, Encontro Conjunto Brasil-Portugal em Matemática, August, 2022.
- Patrícia Gonçalves, An overview on hydrodynamic limits from interacting particles, Encontro Nacional da Sociedade Portuguesa de Matemática, July, 2022.
- Patrícia Gonçalves, On hydrodynamic limits of fractional PDEs from stochastic interacting particle systems, International Congress of Mathematicians 2022, July.
- Patrícia Gonçalves, On hydrodynamic limits of fractional PDEs from stochastic interacting particle systems, Probability and Mathematical Physics, July, 2022.
- Patrícia Gonçalves, Hydrodynamic limits for symmetric exclusion: diffusive versus super-diffusive limits, Probability/PDE Interactions: Interface Models and Particle Systems, April, 2022.
- Patrícia Gonçalves, From the random microscopic motion of particles to deterministic macroscopic laws, ENEMATH 2022, April, 2022.
- Patrícia Gonçalves, From particle systems to partial differential equations, Seminar at Bielefeld, January, 2022.
- John Huerta, An invitation to higher supergeometry, Geometric Structures and Supersymmetry 2022, University of Tromsø, August 25th, 2022.
- John Huerta, Splitting supermanifolds, Geometry and Topology Seminar, Texas Tech University, April 19th, 2022.
- Gabriel Lopes Cardoso, Admissible meromorphic deformations and gravitational field equations, WOTCA 2022, Lisbon, Portugal, June 20-24, 2022.
- Gabriel Lopes Cardoso, The gravitational path integral for $N=4$ BPS black holes from black hole microstate counting, Seminar, Durham University, UK, November 18, 2022.
- Gabriel Lopes Cardoso, The gravitational path integral for $N=4$ BPS black holes from black hole microstate counting, Twelfth Joburg Workshop on String Theory, Wits Rural Facility, Acornhoek, South Africa, December 4-9, 2022.
- Gabriel Lopes Cardoso, Holographic aspects of four-dimensional asymptotically flat $N = 2$ black holes, XV Black Holes Workshop, Lisbon, Portugal, December 19-20, 2022.

- Marco Mackaay, Categorification, 3 lectures at the LMS Research School Bicategories, Categorification and Quantum Theory, University of Leeds, UK, July 11 -15, 2022.
- Marco Mackaay, 2-Representations of affine type A Soergel bimodules: some examples and observations, Algebra and Geometry Seminar. Porto University, Porto, July 20, 2022.
- Marco Mackaay, 2-Representations of affine type A Soergel bimodules: some examples and observations, Uppsala Algebra Seminar. University of Uppsala, Uppsala, Sweden, May 3, 2022.
- Marco Mackaay, 2-Representations of affine type A Soergel bimodules: some examples and observations. Pure Mathematics Seminar, University of East Anglia, Norwich, UK, March 14, 2022.
- Leonardo Macarini, Multiplicity, stability and symmetry of periodic orbits of Reeb flows, Joint meeting Brazil-Portugal in Mathematics, Salvador, Brazil, August 17, 2022.
- Leonardo Macarini, Symmetric closed Reeb orbits on the standard contact sphere, Workshop Two days in Symplectic Dynamics, Lyon, France, September 29, 2022.
- José Matias, The variational encoding of hierarchies of structured deformations, Alghero, ICoNSoM, June 2022.
- José Matias, Relaxation for an optimal design problem in BD, Roma, Two days of PDEs in heterogeneous and irregular structures, La Sapienza, June 2022.
- José Matias, Some recent developments on the theory of structured deformations, Lisboa, 8th ISTIME meeting, September 2022.
- José Matias, Some recent developments on the theory of structured deformations, Seville, 8th Iberian Mathematical meeting, main speaker, October 2022
- José Matias, Some recent developments on the theory of structured deformations, Roma, Seminar at Dipartimento di Scienze di Base e Applicate per L'Ingegneria, La Sapienza, October 2022.
- Filipe Mena, Global evolution and stability of cosmological models, invited talk in plenary session of the 11th Aegean Summer School Recent developments in theory in Gravity and Cosmology and in observations, Syros, Greece (2022).

- Filipe Mena, Mathematical analysis of the Einstein-scalar field system in spherical symmetry, Spanish-Portuguese Relativity Meeting 2022, Salamanca, Spain (2022).
- José Natário, Relativistic elasticity and compactness bounds, Joint Online Mathematical Relativity Colloquium, 3 November 2022.
- João P. Nunes, Evolution of Laughlin states under deformation of geometry, Conference on Quantum Hall effect and Topological phases, IRMA, Strasbourg, June 2022.
- Lina Oliveira, Projections on operator spaces determined by non-associative structures, Workshop on Operator Theory, Complex Analysis, and Applications 2022, University of Algarve, June 20-24, 2022.
- Roger Picken, Higher gauge theory and its connections, CeFEMA Seminar, Técnico, December 7, 2022.
- Carlos Rocha, Order Preserving Semiflows Revisited, 8th IST-IME Meeting, Instituto Superior Técnico, Lisboa, September 9, 2022.
- Makson Santos, Optimal partition problems with volume constraint, 8th Workshop on Analysis and PDEs, November 25, 2022.
- Makson Santos, Improved regularity for the parabolic normalized p-Laplace equation, Nonuniformly elliptic problems conference, September 7, 2022.
- Makson Santos, Improved regularity for the parabolic normalized p-Laplace equation, Three Nonlinear Days in Coimbra, July 14, 2022.
- Makson Santos, Fractional Sobolev Regularity for fully nonlinear elliptic equations, CMM PDE Seminar, May 24, 2022.
- Makson Santos, Fractional Sobolev Regularity for fully nonlinear elliptic equations, Portugal-Italy Conference on Nonlinear Differential Equations and Applications, July 6, 2022.
- Makson Santos, Regularity theory for a non-variational porous medium equation, Lisbon Young Mathematicians Conference, April 14, 2022.
- Delia Schiera, Existence of solutions on the critical hyperbola for a pure Lane-Emden system with Neumann boundary conditions, Universidad de Chile, Centro de Modelamento Matemático, December 6, 2022.
- Delia Schiera, Maximum principles and related problems for a class of non-local extremal operators, 8th Workshop on Analysis and PDEs, Universidade Federal de Sergipe, November 23, 2022.

- Delia Schiera, Maximum principles and related problems for a class of non-local extremal operators, Workshop on Nonlocal and Nonlinear PDEs, Università di Bologna, September 8, 2022.
- Delia Schiera, Principal spectral curves for Lane-Emden fully nonlinear type systems and applications, Workshop Three Nonlinear Days, Universidade de Coimbra, July 13, 2022.
- Delia Schiera, Principal spectral curves for Lane-Emden fully nonlinear type systems and applications, Summer School in Analysis and PDEs, Università degli Studi della Campania L. Vanvitelli, July 7, 2022.
- Delia Schiera, Symmetric positive solutions to nonlinear Choquard equations with potentials, 14th Summer Workshop in Mathematics, Universidade de Brasília (online), January 21, 2022.
- Ricardo Schiappa, Resurgence of (D-Brane) Negativity, Invited Talk Isaac Newton Institute – Final ARA Summary Workshop, Cambridge, UK, December 2022
- Ricardo Schiappa, All Resurgent Instantons, At Last!, Invited Talk First Internal ERC ReNewQuantum Workshop, Odense, Denmark, August 2022
- Ricardo Schiappa, Resurgence Methods and Applications, Invited Lectures Theoretical Physics Courses – Institut de Physique Théorique (IPhT), Paris, France, May 2022
- Ricardo Schiappa, Resurgent Strings and Their Stokes Data, Department of Mathematics, University of Geneva, Geneva, Switzerland, March 2022
- Gunter M. Schuetz, Dynamical universality classes: Recent results and open questions, Discussion Meeting on Statistical Physics: recent developments and future directions, ICTS Bangalore, February 14, 2022
- Gunter M. Schuetz, Mode coupling theory for nonlinear fluctuating hydrodynamics, Minicourse at Math department of IST, July 11-15, 2022
- Gunter M. Schuetz, Dynamical universality classes: Recent results and open questions, Program at Erwin-Schroedinger-Institute Vienna on Large Deviations, Extremes and Anomalous Transport in Non-equilibrium Systems, October 6, 2022.
- Gunter M. Schuetz, A reverse duality for the ASEP with open boundaries, Seminar talk at CY Cergy Paris University, November 28, 2022.

- Gunter M. Schuetz, A reverse duality for the ASEP with open boundaries, Conference on Recent Developments in Stochastic Duality, Eindhoven, December 14, 2022.
- Gunter M. Schuetz, A reverse duality for the ASEP with open boundaries, Seminar talk at Technical University Munich, December 21, 2022.
- Marko Stosic, New Diagrammatics in Double Generalized Majorization Problem, and its applications, ALAMA2022 Conference, Alcala de Henares, Madrid, Spain, May/June 2022.
- Marko Stosic, New invariants of knots and 3-manifolds, XXI Geometrical Seminar, Belgrade, Serbia, June 2022.
- Marko Stosic, Generalized majorization for partitions of integers, and its diagrammatics, 9th International Conference on Matrix Analysis and Applications (ICMAA 2022), Aveiro, Portugal, June 2022.
- Marko Stosic, Combinatorics in matrix pencils completions and low rank perturbations, OSELOT seminar, Warsaw-Berlin-Amsterdam, December 1, 2022.
- Hugo Tavares, Lane-Emden systems with Neumann boundary conditions: existence, regularity and qualitative properties of least energy nodal solutions, 8th Workshop on Analysis and PDEs, Universidade Federal de Sergipe, 23-25 November 2022. (remote)
- Hugo Tavares, Yamabe systems, optimal partitions and nodal solutions to the Yamabe equation, 8th IST-IME Meeting, Instituto Superior Técnico, Lisboa, 5-9 September 2022.
- Hugo Tavares, Yamabe systems, optimal partitions and nodal solutions to the Yamabe equation, Portugal-Italy Conference on Nonlinear Differential Equations and Applications, Univ. Évora July 4-6, 2022.
- Hugo Tavares, Yamabe systems, optimal partitions and nodal solutions to the Yamabe equation, ICMC Summer Meeting on Differential Equations 2022 Chapter (online), 31 January to 2 February, 2022.
- Hugo Tavares, Free boundary problems with long-range interaction, CMAF-cIO Open Meetings 2022, Lisbon (online), 13-14 January 2022
- Hugo Tavares, An overview of gradient elliptic systems with cooperative or competitive interactions: existence, asymptotics and qualitative properties, General Seminar, CMUP, Porto, 9 November 2022.
- Hugo Tavares, Free boundary problems with long-range interaction, SED-NoL: Seminario de Ecuaciones Diferenciales No Lineales, UNAM, Mexico. 22 September 2022 (online).

6 Postdoctoral program and research fellows

The following postdoctoral or research fellows were hosted by the Center in 2022:

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 November 2018).

Pêdra Andrade, PhD in Mathematics, Pontifícia Universidade Católica do Rio de Janeiro, 2020. Research areas: Partial Differential Equations, Regularity Theory. Supported by a CAMGSD Postdoctoral Grant (March 2022 - February 2024).

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 research contract (Sept. 2019 - June 2022).

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 October 2018).

Pedro Boavida de Brito, PhD in Mathematics, WWU-Münster & University of Aberdeen, 2014. Research areas: Algebraic Topology. Supported by an FCT postdoctoral grant (December 2015–November 2021, CAMGSD researcher program (December 2021–November 2022) and FCT Assistant Researcher Contract (since December 2022) .

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 January 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 November 2018).

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 January 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 November 2018).

Emílio Franco, PhD in Mathematics, Universidad Autónoma de Madrid, 2012. Research area: Algebraic Geometry. Supported by an FCT Assistant Researcher Contract (June 2019 - August 2022).

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), by an FCT postdoctoral grant (Jan. 2018 - August 2020) and by an FCT Junior Researcher Contract (September 2020 - June 2022).

Paolo Gregori, PhD in Theoretical Physics, Università degli Studi di Torino, 2018. Research areas: String Theory, Matrix Models, Resurgence Theory and Supersymmetric Gauge Theories. Supported by an FCT project research contract (February 2019 - August 2022).

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 November 2018).

Amin Mohebbi, Doctorate in Mathematics, Universität Augsburg, 2020. Research areas: Symplectic geometry and Hamiltonian dynamics. Supported by an FCT project researcher contract (November 2021 - October 2022).

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 November 2018).

Giuseppe Negro, PhD in Mathematics, Université Paris Nord, 2018, and Universidad Autónoma de Madrid, 2019. Research areas: Partial Differential Equations, Harmonic Analysis. Supported by a CAMGSD Postdoctoral Grant (February 2022 - January 2024).

Makson Santos, PhD in Mathematics, Pontifícia Universidade Católica do Rio de Janeiro, 2020. Research areas: Partial Differential Equations, Regularity Theory. Supported by an FCT project researcher contract (March 2022 - August 2024).

Delia Schiera, PhD in Mathematics, Università degli Studi dell'Insubria, 2019. Research areas: Partial Differential Equations, Nonlinear Analysis Supported by an FCT Junior Researcher Contract (Nov. 2021 - Oct. 2027).

Gunter Schuetz, Dr. rer. nat. Rheinische, Friedrich-Wilhelms-Universität Bonn, 1991. Research areas: Polymer dynamics, driven diffusive systems, quantum spin chains far from equilibrium. Supported by an FCT Principal Researcher Contract (Nov. 2021 - Oct. 2027).

Manfreed Singh, PhD in Mathematics, Indian Institute of Science Education and Research, 2021. Research areas: Knot Theory. Supported by a CAMGSD Postdoctoral Grant (May 2022 - April 2024).

Marko 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), by an FCT Researcher Contract (January 2017 - Oct. 2021) and by an FCT Principal Researcher Contract (Nov. 2021 - Oct. 2027).

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 December 2018).

7 Student supervision

7.1 Doctoral theses

The following doctoral theses were completed in 2022 under the supervision of members of the Center (the name of the student and of the CAMGSD advisor(s) are marked in **bold** characters):

Oslenne Araújo, *Limite de escala para um sistema de partículas com várias leis de conservação*, PhD in Mathematics awarded by Universidade Federal da Paraíba, March 2022. Advised by Alexandre de Bustamente Simas and **Patrícia Gonçalves**.

Carlos Eduardo Alves de Holanda, *Nonadditive Thermodynamic Formalism and Multifractal Analysis for Flows*, PhD in Mathematics awarded by Instituto Superior Técnico. April 2022. Advised by **Luís Barreira**.

Ngo Phuoc Nguyen Ngoc, *Generalized Ising measure for one-dimensional lattice gases and their applications*, PhD in Statistics, University of São Paulo, May 9, 2022. Advised by V. Belitsky and **G.M. Schuetz**

Martí Rosselló Gómez, *Quantum black hole entropy and the Rademacher expansion*, PhD in Mathematics awarded by Instituto Superior Técnico. July 2022. Advised by **Gabriel Lopes Cardoso**.

Pedro Paulo Gondim Cardoso, *Hydrodynamic limit of symmetric exclusion process with long jumps and a slow barrier*, PhD in Mathematics awarded by Instituto Superior Técnico. September 2022. Advised by **Patrícia Gonçalves**.

Augusto Soares Pereira, *Applications of flows in imaginary time to quantization*, PhD in Mathematics awarded by Instituto Superior Técnico. October 2022. Advised by **José Mourão** and **João Pimentel Nunes**.

Roberto Vega Álvarez, *Parametric Resurgences of the Second Painlevé Equation and the Case of 2 Dimensional Quantum Supergravity*, PhD in Mathematics awarded by Instituto Superior Técnico. October 2022. Advised by **Ricardo Schiappa**.

7.2 Master theses

The following master theses were completed in 2022 under the supervision of members of the Center (the name of the student and of the CAMGSD advisor(s) are marked in **bold** characters):

- Ana Alexandra Reis.** *A Roadmap to Quantum Cohomology, From J-holomorphic curves to quantum cohomology*, Master in Mathematics and Applications awarded by Instituto Superior Técnico. January 2022. Advised by **Sílvia Anjos**.
- Tomé Graxinha.** *Normal forms via uniform spectrum for nonautonomous dynamics*, Master in Mathematics and Applications awarded by Instituto Superior Técnico. January 2022. Advised by **Luís Barreira**.
- Pedro Lima da Silva.** *On moduli spaces of vector bundles over smooth projective curves*, Master in Mathematics and Applications awarded by Instituto Superior Técnico. July 2022. Advised by **Emílio Franco**.
- Duarte Nascimento.** *Computing Maslov Indices in Two Dimensions and Filtered Floer Homology of a few Hamiltonians on the Torus*, Master in Mathematics and Applications awarded by Instituto Superior Técnico. July 2022. Advised by **Miguel Abreu**.
- Adrien Jamelot.** *ResNets from a dynamical systems viewpoint*, Master in Mathematics and Applications awarded by Instituto Superior Técnico. September 2022. Advised by **José Mourão**.
- Carolina Paiva.** *Quantum Hall States on Deformed Tori*, Master in Mathematics and Applications awarded by Instituto Superior Técnico. September 2022. Advised by Bruno Mera and **Joana Pimentel Nunes**.
- Pedro Miguel Alves Santos.** *Lagrangian Floer homology of cotangent bundles*, Master in Mathematics and Applications awarded by Instituto Superior Técnico. September 2022. Advised by **Leonardo Macarini**.
- Francisco Matias.** *Galois Covers of Curves and Splittings of the Jacobian Variety*, Master in Mathematics and Applications awarded by Instituto Superior Técnico. November 2022. Advised by **Thomas Baier**.
- Manuel Dias.** *Optimal uniform bounds for competing variational elliptic systems with variable coefficients*, Master in Mathematics and Applications awarded by Instituto Superior Técnico. November 2022. Advised by **Hugo Tavares**.
- Miguel Engrossa.** *Ajuste de modelos compartimentais SIRD e SEIRD à pandemia de COVID-19 em Portugal*, Master in Mathematics and Applications awarded by Instituto Superior Técnico. December 2022. Advised by **Henrique Oliveira**.
- Mónica Sousa.** *Matrix Models in Population Dynamics*, Master in Mathematics and Applications awarded by Instituto Superior Técnico. December 2022. Advised by **Henrique Oliveira**.

Guilherme Azevedo. *Kolyvagin's Euler Systems*, Master in Mathematics and Applications awarded by Instituto Superior Técnico. December 2022. Advised by **Pedro Ferreira dos Santos**.

Luís Dias. *Measurement spaces associated to Fell bundles*, Master in Mathematics and Applications awarded by Instituto Superior Técnico. December 2022. Advised by **Pedro Resende**.

7.3 Graduate and undergraduate students

The following graduate or undergraduate students were supported by CAMGSD or FCT project fellowships in 2022:

António Gouveia MSc student, supervised by João P. Nunes, (15/11/2022 - 14/11/2023)

Francisco Bento MSc student, supervised by Juha Videman, (15/11/2022 - 14/11/2023)

João Silva MSc student, supervised by Hugo Tavares, (15/11/2022 - 14/11/2023)

Manuel Dias MSc student, supervised by Hugo Tavares, (1/1/2022 - 30/6/2022 and 1/7/2022 - 30/6/2023)

Maria Madrugo MSc student, supervised by Pedro Resende, (1/6/2022 - 31/5/2023)

Rui Peixoto MSc student, supervised by John Huerta, (1/6/2022 - 31/5/2023)

8 Publications in 2022

8.1 Publications which appeared in 2022

Books & Monographs

- [1] L. Oliveira. *Linear Algebra*. Chapman and Hall/CRC, 2022. 328 p.

Articles in refereed international journals

- [1] M. Abreu and L. Macarini. Dynamical implications of convexity beyond dynamical convexity. *Calc. Var. Partial Differential Equations*, 61(3):116, 2022. arXiv:2106.10245.
- [2] M. Abreu, L. Macarini, and M. Moreira. On contact invariants of non-simply connected Gorenstein toric contact manifolds. *Math. Res. Lett.*, 29(1):1–42, 2022. arXiv:1812.10361.
- [3] R. Ahmed, C. Bernardin, P. Gonçalves, and M. Simon. A microscopic derivation of coupled SPDE’s with a KPZ flavor. *Ann. Inst. H. Poincaré Probab. Statist.*, 58(2):890–915, 2022. arXiv:1910.03996.
- [4] A. Alho, W. C. Lim, and C. Uggla. Cosmological global dynamical systems analysis. *Classical Quantum Gravity*, 39(14):145010, 2022. arXiv:2201.07596.
- [5] A. Alho, J. Natário, P. Pani, and G. Raposo. Compact elastic objects in general relativity. *Phys. Rev. D (3)*, 105(4):044025, 2022. arXiv:2107.12272.
- [6] A. Alho, J. Natário, P. Pani, and G. Raposo. Compactness bounds in general relativity. *Phys. Rev. D (3)*, 106(4):L041502, 2022. arXiv:2202.00043.
- [7] M. Amar, J. Matias, M. Morandotti, and E. Zappale. Periodic homogenization in the context of structured deformations. *Z. Angew. Math. Phys.*, 73(4):173, 2022. arXiv:2203.12769.
- [8] P. Aniceto, G. Lopes Cardoso, and S. Nampuri. Observations on holographic aspects of four-dimensional asymptotically flat $N = 2$ black holes. *J. High Energy Phys.*, 2022(5):142, 2022. arXiv:2111.13190.
- [9] F. Araújo and P.R. Pinto. Representations of Higman-Thompson groups from Cuntz algebras. *J. Math. Anal. Appl.*, 509(2):125970, 2022. arXiv:2011.13679.

- [10] L. Barreira and C. Holanda. Dimension spectra for flows: future and past. *Nonlinear Anal. Real World Appl.*, 65:103497, 2022.
- [11] L. Barreira and C. Holanda. Higher-dimensional nonlinear thermodynamic formalism,. *J. Statist. Phys.*, 187(2):18, 2022.
- [12] L. Barreira and C.E. Holanda. Nonlinear thermodynamic formalism for flows. *Dyn. Syst.*, 37(4):603–629, 2022.
- [13] L. Barreira and C. Valls. Evolution maps and admissibility. *Mediterr. J. Math.*, 19(1):28, 2022.
- [14] L. Barreira and C. Valls. Evolution maps and symmetry. *J. Difference Equ. Appl.*, 28(3):355–384, 2022.
- [15] L. Barreira and C. Valls. New regularity coefficients. *Electron. J. Qual. Theory Differ. Equ.*, 2022(1):1–25, 2022.
- [16] L. Barreira and C. Valls. Normal forms for equivariant differential equations. *J. Dynam. Differential Equations*, 34(2):1371–1392, 2022.
- [17] L. Barreira and C. Valls. Regularity of normal forms on parameters. *Milan J. Math.*, 90(1):1–15, 2022.
- [18] L. Barreira and C. Valls. Some applications of Lyapunov regularity. *Electron. J. Differential Equations*, 2022(19):1–25, 2022.
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- [20] V. Barros, S. Correia, and F. Oliveira. On the nonlinear Schrödinger equation in spaces of infinite mass and low regularity. *Differential Integral Equations*, 35(7/8):371–392, 2022. arXiv:2011.03289.
- [21] C. Bernardin, P. Gonçalves, M. Jara, and S. Scotta. Equilibrium fluctuations for diffusive symmetric exclusion with long jumps and infinitely extended reservoirs. *Ann. Inst. H. Poincaré Probab. Statist.*, 58(1):303–342, 2022. arXiv:2002.12841.
- [22] C. Bernardin, P. Gonçalves, B. Oviedo-Jiménez, and S. Scotta. Non-equilibrium stationary properties of the boundary driven zero-range process with long jumps. *J. Statist. Phys.*, 189(3):32, 2022. arXiv:2201.07573.
- [23] O. Bertolami, M. M. Lima, and F. C. Mena. Primordial magnetic fields in theories of gravity with non-minimal coupling between curvature and matter. *Gen. Relativity Gravitation*, 54(8):82, 2022. arXiv:2204.06883.

- [24] D. Betea, P. Ferrari, and A. Occelli. The half-space Airy stat process. *Stochastic Process. Appl.*, 146:207–263, 2022. arXiv:2012.10337.
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- [27] F.S. Cal, G.A.S. Dias, and B.M.M. Pereira. Trapped modes in a fluid with three layers topped by a rigid lid. *Math. Methods Appl. Sci.*, 45(16):9928–9944, 2022.
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- [68] J. Llibre and C. Valls. The improved Euler-Jacobi formula and the planar polynomial vector fields of degree 2 – 4. *Bull. Belg. Math. Soc. Simon Stevin*, 29(1):62–86, 2022.
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- [74] J. Llibre and C. Valls. Twin polynomial vector fields of arbitrary degree. *Bull. Braz. Math. Soc. (N.S.)*, 53(1):295–306, 2022.

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- [77] H. M. Oliveira and S. Perestrelo. Stability of coupled Huygens oscillators. *J. Difference Equ. Appl.*, 28(10):1362–1380, 2022.
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- [84] C. Valls. Trigonometric polynomial solutions of Bernoulli trigonometric polynomial differential equations. *Mathematics*, 10(21):4022, 2022.

Book chapters

- [1] M.C. Câmara, K. Klis-Garlicka, and M. Ptak. (Asymmetric) dual truncated Toeplitz operators. In R.M. Aron, M.S. Moslehian, I.M. Spitkovsky, and H.J. Woerdeman, editors, *Operator and Norm Inequalities and Related Topics*, Trends in Mathematics, pages 429–460. Birkhäuser, 2022.

Other publications

8.2 Accepted publications (submitted or accepted in 2022)

Books & Monographs

- [1] L. Barreira and Y. Pesin. *Introduction to Smooth Ergodic Theory: Second Edition*, volume 231 of *Graduate Studies in Mathematics*. American Mathematical Society, to appear.

Articles in refereed international journals

- [1] A. Alho, S. Calogero, and A. Liljenberg. Self-gravitating static balls of power-law elastic matter. *Adv. Theor. Math. Phys.*, to appear. arXiv:2104.11131.
- [2] A. Alho, C. Ugglä, and J. Wainwright. Quintessence from a state space perspective. *Phys. Dark Universe*, to appear. arXiv:2209.09684.
- [3] M. E. Anacleto, J. Llibre, C. Valls, and C. Vidal. Crossing limit cycles for discontinuous piecewise linear differential centers separated by three parallel straight lines. *Rend. Circ. Mat. Palermo (2)*, to appear.
- [4] M.E. Anacleto, J. Llibre, C. Valls, and C. Vidal. Limit cycles of a continuous piecewise differential system formed by a quadratic center and two linear centers. *Bol. Soc. Mat. Mexicana (3)*, to appear.
- [5] S. Anjos, M. Barata, M. Pinsonnault, and A.A. Reis. Loops in the fundamental group of $\text{Symp}(\mathbb{CP} \# 5\mathbb{CP}^2, \omega)$ which are not represented by circle actions. *Canad. J. Math.*, to appear. arXiv:1910.02796.
- [6] P.R.S. Antunes, F.P. da Costa, J.T. Pinto, and R. Sasportes. Modelling silicosis: Dynamics of a model with piecewise constant rate coefficients. *J. Dynam. Differential Equations*, to appear. arXiv:2109.01172.
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- [8] L. Barreira, J. Llibre, and C. Valls. On the global nilpotent centers of cubic polynomial Hamiltonian systems. *Differential Equations Dynam. Systems*, to appear.

- [9] L. Barreira and C. Valls. Perturbations with nonpositive Lyapunov exponents. *Quaest. Math.*, to appear.
- [10] L. Barreira and C. Valls. Center manifolds for delay-differential equations with variable argument. *Period. Math. Hungar.*, to appear.
- [11] L. Barreira and C. Valls. Characterizations of hyperbolicity in difference equations with delay. *Results Math.*, to appear.
- [12] L. Barreira and C. Valls. Evolution groups and reversibility. *Annal. Funct. Anal.*, to appear.
- [13] L. Barreira and C. Valls. Evolution maps for delay-difference equations. *J. Differential Equations*, to appear.
- [14] L. Barreira and C. Valls. Perturbations of tempered spectra. *Linear Multilinear Algebra*, to appear.
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8.3 Manuscripts submitted (but not yet accepted) in 2022

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- [2] M. Abreu, L. Macarini, and M. Moreira. Contact invariants of $\mathbb{Q}$ -Gorenstein toric contact manifolds, the ehrhart polynomial and chenruan cohomology. arXiv:2202.00442.
- [3] A. Alho, F. C. Mena, and V. Bessa. Dynamics of interacting monomial scalar field potentials and perfect fluids. arXiv:2212.02942.
- [4] P. D.S. Andrade, D. dos Prazeres, and M. Santos. Regularity estimates for fully nonlinear integro-differential equations with nonhomogeneous degeneracy. arXiv:2302.00423
- [5] A. Arakelyan and F. Bozorgnia. Uniqueness of a solution to a general class of discrete system defined on connected graphs. arXiv:2207.11957.
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9 Editorials

Miguel Abreu

- Portugaliae Mathematica

Luís Barreira

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

M. Cristina Câmara

- Journal of Mathematical Analysis and Applications

Patrícia Gonçalves

- Annals of Applied Probability
- Annals of 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

- European Mathematical Society Magazine

Pedro Resende

- Surveys in Mathematics and Applications

Carlos Rocha

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

Gunter Schuetz

- Journal of Statistical Physics
- Diffusion Fundamentals

Hugo Tavares

- Gazeta da Matemática

Claudia Valls

- Nonlinear Analysis: Real World Applications

Juha Videman

- Applications in Engineering Science
- Fluids

10 Partnership and outreach

Participation in the Programme **Novos Talentos Científicos da Fundação Calouste Gulbenkian – 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**

14th Winter School - 2022, IST, February 18–19, 2022.

Outreach activities by individual members

Pêdra Andrade was a member of the organizing committee of XI Escola de Verão em Matemática da Universidade Federal de Sergipe, Aracaju, Brazil, January-March, 2022.

Pêdra Andrade was a member of the organizing committee of the 8th Workshop on Analysis and PDEs, Aracaju, Brazil, 23-25 November, 2022.

Sílvia Anjos gave a lecture *An introduction to Symplectic Geometry* in the Workshop "Gulbenkian New Talents in Mathematics", April 2, 2022.

Patrícia Gonçalves was a member of the Scientific Committee of the international meeting Particle Systems and Partial Differential Equations X, University of Minho, June.

Patrícia Gonçalves organizes (together with Chiara Franceschini, Claudio Landim, Pablo Ferrari, Marielle Simon and Sunder Sethuraman) the Probability and Statistical Mechanics Seminar.

Luís Filipe Costa participated in the Jornadas de Ciência de Arouca 2022, co-mentoring (joint with their teachers) highschool students, and as a member/speaker in the panel *Novos desafios da Ciência*, Arouca, Portugal, December 2022.

Filipe Mena was member of the Local Organising Committee of the 2022 Iberian Gravitational Waves Meeting, Universidade do Minho, June 6-8, 2022.

Filipe Mena was member of the Scientific Committee of the 1-day Meeting in Geometry, Topology and Applications, Universidade do Minho, November 23, 2022.

Filipe Mena was member of the Scientific Committee of the international meeting XV Black Holes workshop, ISCTE – University Institute of Lisbon, December 19-20, 2022.

Roger Picken, gave the presentations *Matemática e nós de gravata (Mathematics and Tie Knots)* and *Emaranhados racionais e Contas com cordas (Rational Tangles and Calculating with Ropes)* at Dia do Técnico (Técnico Day), May 23, 2022.

Marko Stosic gave the talk *Funções Polinomiais Simétricas (Symmetric Polynomial Functions)* at Delfos, Departamento de Matematica, Universidade de Coimbra, May 2022.

Juha Videman co-organized a minisymposium Computational Methods in Contact Mechanics within the ECCOMAS Congress 2022, Oslo, Norway, June 5-9, 2022.

11 Personal notes

Miguel Abreu was elected corresponding member of the Lisbon Academy of Sciences.

Luís Filipe Costa was given, by the Institute of Physics Publishing (IOP), an Outstanding Reviewer award 2022, for his reviewing work for the journal *Classical and Quantum Gravity* as well as an *IOP trusted reviewer* status.

Fernando P. da Costa was one of the delegates of Portugal to the General Assembly of the International Mathematical Union (Helsinki, Finland, July 2022).

Fernando P. da Costa is president of the Teaching Staff Evaluation Board of the Universidade Aberta.

Fernando P. da Costa is vice-president of the Portuguese Mathematical Society.

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

Patrícia Gonçalves is president of the Scientific Council of IST-ID.

Patrícia Gonçalves acted as a reporter for the PhD thesis of Simone Floreani at the University of Delft.

Patrícia Gonçalves participated in a round table of the meeting Second meeting of women in mathematics at IMPA, May, IMPA.

Patrícia Gonçalves participated in a round table of the meeting SBM on the submission of articles, April, SBM, Brazil.

Leonardo Macarini, 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.

Filipe Mena was member of the PhD thesis committee of Thanakis Giannakopoulos at IST, September 2022.

Filipe Mena was a member of the Jury for 2 Junior Researcher contracts in Mathematics and Physics, within FCT project CERN/FIS-PAR/0027/2019, Universidade de Aveiro.

Filipe Mena has been President of the Portuguese Society of Relativity and Gravitation (SPRG).

Roger Picken was a member of the Scientific Committee of the XXX International Fall Workshop on Geometry and Physics, ICMAT, Madrid, Spain, August 29 - September 2, 2022.

Ricardo Schiappa organized the Workshop ARA – Physical Resurgence: On Quantum, Gauge, and Stringy, INI-Cambridge 2022.

Ricardo Schiappa co-organized the Program Applicable Resurgent Asymptotics: Towards a Universal Theory, Newton Institute Research Programme, INI-Cambridge 2022

Carlos Rocha Carlos Rocha gave his last class, entitled *Dinâmica em Dimensão Infinita*, at IST, Universidade de Lisboa, in July 12, 2022.

Hugo Tavares is member of the Scientific Committee of the program Novos Talentos Científicos, in the field of Mathematics.