Talks

Gabriel Lopes Cardoso

Instituto Superior Técnico, Portugal

gcardoso@math.ist.utl.pt

The holomorphic anomaly equation and the Hesse potential

Special geometry is based on a holomorphic function $F(X)$, with an associated vector $(X^I, \partial F/\partial X^I)$ that undergoes symplectic transformations. The Hesse potential of special geometry is related to $F(X)$ by a Legendre transformation, and it is expressed in terms of real variables that transform as canonical variables under symplectic transformations. Using the formulation based on the Hesse potential, we show that special geometry can be consistently deformed by a class of non-holomorphic terms that satisfy the so-called holomorphic anomaly equation of topological string theory.

Luís Castro

CIDMA- Centro de Investigação e Desenvolvimento em Matemática e Aplicações, Departamento de Matemática, Universidade de Aveiro, Portugal

castro@ua.pt

Boundary integral methods for classes of wedge diffraction problems with Dirichlet, Neumann and impedance boundary conditions

We will consider wedge diffraction problems in the form of boundary value problems for the Helmholtz equation in the exterior of a quadrant in a Bessel potential space framework. The problems will be formulated by using the Helmholtz equation subjected to different possible combinations of boundary conditions on the faces of the corresponding wedge. Namely, under consideration there will be boundary conditions of Dirichlet-Dirichlet, Neumann-Neumann, Neumann-Dirichlet, impedance-Dirichlet, and impedance-Neumann types. Existence and uniqueness results are proved for all these cases in the weak formulation. In addition, representations of the solutions are obtained within the spaces in consideration, and higher regularity of solutions is also

obtained in a scale of Bessel potential spaces. The talk is based on a joint work with D. Kapanadze.

Isabelle Chalendar

Université de Lyon, France

chalenda@math.univ-lyon1.fr

An extremal problem for characteristic functions

We examine a dual extremal problem involving characteristic functions of subsets of the unit circle and solve it in some important cases. The techniques used involve the theory of Toeplitz and Hankel operators as well as the construction of certain conformal mappings. This is a joint work with S. Garcia, W. Ross and D. Timotin

---

Carl Cowen

Indiana University-Purdue University Indianapolis, USA

cowen@math.purdue.edu

Some Old and Some New Thoughts on Commutants of Analytic Multiplication Operators

Except in special circumstances, it is usually quite difficult to determine conditions that characterize which operators commute with a given operator. Such special circumstances include use of the spectral theorem for self-adjoint or normal operators and cases in which the operator in question has a rich point spectrum. The results in this latter situation come from the application of the fairly trivial observation that if A and B commute, the eigenspaces of A are invariant for B.

If $\mathcal{H}$ is a Hilbert space of analytic functions on the unit disk and T_z is the operator of multiplication by z, it is well known that the commutant of T_z is the collection of multiplication operators T_f where f is a bounded analytic function on the disk and $(T_f h)(z) = f(z)h(z)$.

In the 1970's and 80's, the question "Which operators on the Hardy space $H^2(\mathbb{D})$ commute with T_f for f a bounded analytic function on the disk?" was

investigated. More recently, there has been interest in this question for the Bergman space $A^2(\mathbb{D})$. In this talk, an overview of the work of thirty years ago will be presented and we will consider this question for $f = B$, a finite Blaschke product, for T_B acting on the Bergman space, a question that has wider consequences than might be expected.

Daniel Girela

(Universidad de Málaga, Spain

girela@uma.es

Generalized Hilbert Operators on Hardy spaces

The Hilbert matrix $H = \left(\frac{1}{n+k+1}\right)_{k,n\geq 0}$ can be viewed as an operator acting on spaces of analytic functions in the unit disc $\mathbb{D}$, called the *Hilbert operator*, by its action on the Taylor coefficients: if $f(z) = \sum_{k=0}^{\infty} a_k z^k \in \mathcal{H}ol(\mathbb{D})$, we define

$$\mathcal{H}(f)(z) = \sum_{n=0}^{\infty} \left(\sum_{k=0}^{\infty} \frac{a_k}{n+k+1} \right) z^n,$$

whenever the right hand side makes sense and defines and analytic function in $\mathbb{D}$. The Hilbert operator acting on Hardy spaces and Bergman spaces has been extensively studied. It is known that $\mathcal{H}$ is bounded from H^p to H^p, whenever $1 < p < \infty$ but is not bounded on H^1. Concerning the Bergman spaces A^p, the operator $\mathcal{H}$ is bounded form A^p to A^p if and only if $2 < p < \infty$, but $\mathcal{H}$ is not even defined in A^2.

It turns out that $\mathcal{H}(f)$ can be written also in the form,

$$\mathcal{H}(f)(z) = \sum_{n=0}^{\infty} \left(\int_0^1 t^n f(t)\, dt \right) z^n = \int_0^1 f(t) \frac{1}{1-tz}\, dt \int_0^1 f(t) g'(tz)\, d\zeta,$$

with $g(z) = \log \frac{1}{1-z}$.

If g is an analytic function in the unit disc $\mathbb{D}$ we consider the generalized Hilbert operator $\mathcal{H}_g$ defined by

$$\mathcal{H}_g(f)(z) = \int_0^1 f(t) g'(tz)\, dt.$$

We address the question of characterizing the functions g for which the operator $\mathcal{H}_g$ is bounded (compact) on the Hardy spaces H^p, and on some other related spaces.

This talk is based on a work in collaboration with P. Galanopoulos, J. A. Peláez, and A. Siskakis.

Eva Gallardo Gutiérrez

Universidad Complutense de Madrid, Spain

eva.gallardo@mat.ucm.es

Locally univalent functions, VMOA and the Dirichlet space

In the present talk, we will exhibit properties of the image of the unit circle under a bounded locally univalent function g such that $\log g$ belongs either to the Dirichlet space, VMOA or the little Bloch space. Concerning VMOA and the little Bloch space, our findings generalize the corresponding results for conformal maps shown by Pommerenke in the late 1970s. In the case of the Dirichlet space D, we will present a conjecture by Peter Jones for g to satisfy $\log g \in D$, and prove a geometric necessary condition supporting such conjecture (joint work with M. J. Gonzalez, F. Perez, Ch. Pommerenke and J. Rattya).

Andreas Hartmann

Université Bordeaux I, France

Andreas.Hartmann@math.u-bordeaux1.fr

Reverse Carleson measures in de Branges-Rovnyak spaces

For a Hilbert space H of homorphic functions on a domain $\Omega \subset \mathbb{C}$, we call (whenever this makes sense) μ a Carleson measure when $\|f\|_{L^2(\mu)} \lesssim \|f\|_H$, and a reverse Carleson measure when $\|f\|_H \lesssim \|f\|_{L^2(\mu)}$, $f \in H$. Carleson characterized Carleson measures for the Hardy space H^2, and Carleson measures are now well studied objects for broad classes of function spaces. The investigation of reverse Carleson measures started rather recently. In a paper by Lefèvre et al. (2012), the authors charactized reverse Carleson measures

for the Hardy space H^2. We discuss this question in a subclass of Hilbert spaces of H^2, namely in de Branges-Rovnyak spaces $\mathscr{H}(b)$ where b is a holomorphic function bounded by 1. The space $\mathscr{H}(b)$ being a range space for a certain operator defined on H^2, there is no explicit norm for $\mathscr{H}(b)$, so that there is some interest in studying reverse and/or direct Carleson mesures for these spaces. We also discuss some results for direct Carleson measures, and obtain as a byproduct that there are no isometric Carleson measures in $\mathscr{H}(b)$. This is joint work with Alain Blandignères, Emmanuel Fricain, Frédéric Gaunard and William T. Ross.

David Krejcirik

Nuclear Physics Institute ASCR, Czech Republic

david@ujf.cas.cz

The Cheeger constant and why one should avoid corners

We give an introductory talk on a geometric minimisation problem associated with non-linear partial differential equations arising in the context of image denoising and reconstruction. We then present our results obtained for domains obtained as tubular neighbourhoods of curves in the plane. This is a joint work with Aldo Pratelli.

Rui Marreiros

Universidade do Algarve, Portugal

rmarrei@ualg.pt

On the dimension of the kernel of a singular integral operator with shift and conjugation

On the Hilbert space $L_2(\mathbb{T})$ we consider the singular integral operator with non-Carleman shift and conjugation $K = P_+ + (aI + AC)P_-$, where $P_\pm$ are the Cauchy projectors, $A = \sum_{j=0}^{m} a_j U^j$, a, a_j, $j = \overline{1, m}$, are continuous functions on the unit circle $\mathbb{T}$, U is the shift operator and C is the operator of complex conjugation. An estimate for dimension of the kernel of the operator K is obtained.

Martin Mathieu
Queen's University Belfast, UK
m.m@qub.ac.uk

Spectrally bounded and spectrally isometric operators

We give an overview on recent advances in the understanding of spectrally bounded and spectrally isometric operators between Banach algebras.

Gaspar Mora Martinez
Universidad de Alicante, Spain
gaspar.mora@ua.es

On the real parts of the zeros of the partial sums of the Riemann zeta function

Every *nth* partial sum of the Riemann zeta function, $\zeta_n(z) = \sum_{k=1}^{n} \frac{1}{k^z}$, has all its zeros situated on a strip $S^{(n)} = \{z : a^{(n)} \leq \operatorname{Re} z \leq b^{(n)}\}$, called critical strip, where $a^{(n)} = \inf\{\operatorname{Re} z : \zeta_n(z) = 0\}$ and $b^{(n)} = \sup\{\operatorname{Re} z : \zeta_n(z) = 0\}$. In this talk we show that there exists N such that for any $n > N$ the set $\{\operatorname{Re} z : \zeta_n(z) = 0\}$ is dense in $[a^{(n)}, b^{(n)}]$. That means that every $\zeta_n(z)$ possesses zeros arbitrarily close to any vertical line contained in $S^{(n)}$, provided that $n > N$.

Jonathan R. Partington
University of Leeds, UK
J.R.Partington@leeds.ac.uk

Weighted composition operators on the half-plane

We discuss the boundedness of weighted composition operators on a wide class of spaces of analytic functions on the half-plane (Zen spaces), which includes Hardy spaces and weighted Bergman spaces. In the unweighted case the results are related to some surprising norm estimates given by Elliott, Jury and Wynn. This is joint work with Isabelle Chalendar (Lyon).

Marek Ptak
University of Agriculture of Krakow, Poland
rmptak@cyf-kr.edu.pl

On the reflexivity of subspaces of Toeplitz operators in simply connected regions

The reflexivity and transitivity of subspaces of Toeplitz operators on the Hardy space over the Jordan region – a simply connected region in the complex plane with analytic Jordan curve as its boundary – is investigated. The dichotomic behavior (either reflexivity or transitivity) of these subspaces will be shown. It refers to the similar dichotomic behavior of subspaces of Toeplitz operators on the Hardy space over the unit disc. Joint work with W. Młocek.

Juan Sánchez Rodríguez
Universidade do Algarve, Portugal
jsanchez@ualg.pt

Rational matrix factorization and difference equations

The matrix-function factorization find applications in many fields like diffraction theory, the theory of differential equations and the theory of singular integral operators. However, only for a few classes of matrices is known the explicit formulas for the factors of the factorization.

Our talk will be devoted to the relation between the factorization of rational matrices on the unit circle and the solution of a linear system of difference equations with constant coefficients. We also will provide some useful examples.

Eugene Shargorodsky
King's College London, UK
eugene.shargorodsky@kcl.ac.uk

Toeplitz operators with bounded measurable coefficients

The talk is intended as a review of some results obtained over the last decade in the study of the essential spectra of Toeplitz operators with bounded measurable coefficients and, more importantly, of some open problems in the

field. In particular, an optimal sufficient condition for a point to belong to the essential spectrum of a Toeplitz operator will be discussed. The optimality of this condition was established in a joint work with S. Grudsky where the main ingredient was a sufficient condition for a composition of a Muckenhoupt weight with a Blaschke product to belong to the same Muckenhoupt class.

Petr Siegl

University of Bern, Switzerland

petr.siegl@math.unibe.ch

Basis properties of perturbations of the harmonic oscillator type operators

We analyze perturbations of the harmonic oscillator type operator in a Hilbert space, i.e. of the self-adjoint operator with simple positive eigenvalues μ_k satisfying $\mu_{k+1} - \mu_k \geq \Delta > 0$. Perturbations are considered in the sense of quadratic forms. Under a "local subordination assumption", the eigenvalues of the perturbed operator become eventually simple and the root system forms a Riesz basis. The motivation, the origin of the "local subordination assumption", and several examples will be discussed as well.

The talk is based on the results obtained with B. Mityagin (OSU, Columbus, OH, USA) and partially on the joint work with D. Krejčiřík (NPI, Řež, Czech Republic), M. Tater (NPI, Řež, Czech Republic), and J. Viola (University of Nantes, France).

Franciszek Hugon Szafraniec

Institute of Mathematics of the Jagiellonian University, Poland

umszafra@cyf-kr.edu.pl

Coherent states without measure

My intension is to implemented what the title promisses. It will be based on the two following papers:

A measure free approach to coherent states, J. Phys. A: Math. Theor. 45 (2012) 244018 (with Andrzej Horzela).

A measure free approach to coherent states refined, Proceedings of the XXIX International Colloquium on Group-Theoretical Methods in Physics, World Scientific, Singapore, to appear (with Andrzej Horzela).

Estelita Vaz

Universidade do Minho, Portugal

evaz@mct.uminho.pt

Inheritance of spherical symmetry: relevant operators

Spherically symmetric spacetimes are important for the astrophysical modelling in general relativity. These spacetimes possess three Killing vector fields, as known from the literature, which characterize the symmetry of the spacetime. In this talk, relevant operators are presented, such as the metric connections and their projections, the pull-back operator and the Lie derivative, which play an important role in the heritance of symmetries of the material space from the spacetime manifold when studying elastic properties.

Jani Virtanen

University of Reading, UK

j.a.virtanen@reading.ac.uk

Riemann-Hilbert problems in Hardy spaces

We consider the (non)existence of solutions of the Riemann-Hilbert problem in Hardy spaces, and show how the behavior of the symbol near its zeros affects the existence of solutions. We mainly focus on the class of scalar-valued continuous symbols, but may also mention other classes of (matrix-valued) symbols. Some applications to spectral theory of Toeplitz operators and hydrodynamics will also be mentioned.

Posters

Rita Guerra
Universidade de Aveiro, Portugal
ritaguerra@ua.pt

Hyers-Ulam-Rassias stability of Volterra integral equations

We obtain weak conditions to guarantee the Hyers-Ulam-Rassias stability of (nonlinear) Volterra integral equations with delay. In particular, this leads to a generalization of some results previously known. Basically, this is done by using certain weight functions in the framework of the space of continuous functions. Indeed, the method consists in a convenient combination of the classical Banach fixed point theorem together with a consideration of a weighted metric. Therefore, we avoid the consideration of generalized metrics. In addition, a successive approximation method will be also applied to the study of a corresponding Hyers-Ulam stability. This is based on a joint work with L. P. Castro.

Sérgio Mendes
Instituto Universitário de Lisboa, Portugal
sergio.mendes@iscte.pt

The reduced C^*-algebra of $SL_2(\mathbb{F}_2((\varpi)))$

Let $\mathbb{F}_2((\varpi))$ denote the Laurent series in the indeterminate ϖ with coefficients over the finite field with two elements $\mathbb{F}_2$. This is a local nonarchimedean field with characteristic 2. We show that the structure of the reduced group C^*-algebra of $SL_2(\mathbb{F}_2((\varpi)))$ is determined by the arithmetic of the ground field. Specifically, the algebra $C_r^* SL_2(\mathbb{F}_2((\varpi)))$ has countably many noncommutative summands, induced by the Artin-Schreier symbol.

Eloísa Pires
Instituto Superior Técnico, Portugal
eloisa.grifo@gmail.com

On the Gelfand transform of the Daniele-Khrapkov algebra

We consider a Banach algebra $\mathscr{D}$ of 2×2 matrix functions, continuous in $\dot{\mathbb{R}}$, and show that its space of multiplicative linear functionals can be identified with a composed contour Γ in a torus. We show that $\mathscr{D}$ is a semi-simple Banach algebra and we use the Gelfand transform to identify each element in $\mathscr{D}$ with a continuous function in Γ and to obtain a factorization of the matrix elements of $\mathscr{D}$.

This poster is based on work in progress with M. C. Câmara.
