Titles and Abstracts for the International Conference on Orthogonal Polynomials and q-Series May 10 - 12, 2015, University of Central Florida

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Richard Askey (askey@math.wisc.edu) – University of WisconsinMadison

Some of what I owe to Mourad Ismail and some elementary inequalities, both old and new

Abstract: Through the years Mourad has come up with some gems which have been very useful and/or surprising to me. I will describe a few of these. The second part of the talk will be completely different, no orthogonal polynomials or q-series, just a few inequalities involving polynomials and some consequences.

George Andrews (gea1@psu.edu) – The Pennsylvania State University

Bressoud's easy proof of the Rogers-Ramanujan identities and Bressoud polynomials

Abstract: In 1974, a multiple series generalization of the Rogers-Ramanujan identities was proved. In 1983, David Bressoud published "An Easy Proof of the Rogers-Ramanujan identities." The main body of the paper provided exactly what was promised in the title. The paper concludes with a multiple series of generalization that has multiple suprises beneath the surface. We hope to illuminate some these surprises.

Bruce Berndt (berndt@math.uiuc.edu) – University of Illinois at Urbana-Champaign

Mathematical Connections Between Ramanujan and Hardy in Ramanujan's Earlier Notebooks and Lost Notebook

Abstract: The joint work of Hardy and Ramanujan in their published papers continues to have a huge impact on contemporary research in number theory, combinatorics, and analysis. We do not discuss these contributions in this talk, but instead focus on the impact that each had on the other as evinced in several entries in the notebooks and lost notebook. The famous unsolved circle, divisor, and extended divisor problems, and the Riemann zeta function are featured. Most of this lecture is based on joint work with Atul Dixit, Sun Kim, Arindam Roy, and Alexandru Zaharescu.

M. El Bachraoui (melbachraoui@uaeu.ac.ae) – UAE University

On polynomiality of q-binomial coefficients

Abstract: We provide a characterization of the polynomiality of the q-binomial coefficients and therefore also a characterization of congruence for the binomial coefficients. As an application we give a simple proof for a recent theorem by Guo and Krattenthaler.

Yang Chen (yayangch@umac.mo) – University of Macau, China

Hankel determinants, singular perturbation, greater to lesser Painleve III

Abstract: In this talk, I will discuss Hankel determinant generated by a Laguerre weight multiplied by $\exp(-t/x), t > 0$, inducing an infinitely fast 0 at the origin. For finite n, the Hankel determinant, is expressed in terms a finite n Painleve III. Under double scaling where $n \to \infty$ and $t \to 0$, such that $s := 2nt$ is finite, the original PIII becomes a lesser PIII. The large s asymptotic expansion of the scaled, and in some sense, infinite determinant is obtained.

This talk ends with a discussion of the constant term in the large s expansion.

Howard Cohl (howard.cohl@nist.gov) –Applied and Computational Mathematics Division, NIST

Newtonian potential theory and superintegrability on hyperspheres

Abstract: A fundamental solution and fundamental solution expansions are presented for the Laplace-Beltrami operator on the d-dimensional hypersphere. The Newtonian potential is obtained for the 2-disc on the 2-sphere and 3-ball and circular curve segment on the 3-sphere. Applications are also given to the d-dimensional superintegrable Kepler-Coulomb and isotropic oscillator potentials.

Roberto Costas (figaro@arquired.es) – Universidad de Alcala, SPAIN

Extensions of discrete orthogonal polynomials beyond the orthogonality

Abstract: It is well-known that the some family of discrete orthogonal polynomials are orthogonal up to degree N with respect to a certain weight function. By using the three-term recurrence relation which these families fulfill, we prove that such families can be characterized by a $\triangle$-Sobolev orthogonality for every degree n and present a factorization for these polynomials for degrees higher than N.

Dan Dai (dandai@cityu.edu.hk) – City University of Hong Kong, China

Painleve III asymptotics of Hankel determinants for a singularly perturbed Laguerre weight

Abstract: We consider the Hankel determinants associated with the singularly perturbed Laguerre weight $w(x) = x^\alpha e^{-x-t/x}$, $x \in (0, \infty)$, $t > 0$ and $\alpha > 0$. When the matrix size $n \to \infty$, we obtain an asymptotic formula for the Hankel determinants, valid uniformly for $t \in (0, d]$, $d > 0$ fixed. A particular Painlevé III transcendent is involved in the approximation, as well as in the large-n asymptotics of the leading coefficients and recurrence coefficients for the corresponding perturbed Laguerre polynomials. The derivation is based on the asymptotic results in an earlier paper of the authors, obtained by using the Deift-Zhou nonlinear steepest descent method.

This is a joint work with Shuai-Xia Xu and Yu-Qiu Zhao.

Karl Dilcher (dilcher@mathstat.dal.ca) – Dalhousie University, Canada

Higher-order convolutions for Bernoulli and Euler polynomials

Abstract: We prove convolution identities of arbitrary orders for Bernoulli and Euler polynomials, i.e., sums of products of a fixed but arbitrary number of these polynomials. They differ from the more usual convolutions found in the literature by not having multinomial coefficients as factors. This generalizes a special type of convolution identity for Bernoulli numbers which was first discovered by Yu. Matiyasevich.

This talk is based on joint work with T. Agoh (Tokyo University of Science).

Atul Dixit (adixit@tulane.edu) – Tulane University

Zagier polynomials, their asymptotics and exact formulas

Abstract: In 1998, Don Zagier studied the "modified Bernoulli numbers" B_n^* whose 6-periodicity for odd n naturally arose from his new proof of the Eichler-Selberg trace formula. These numbers satisfy amusing variants of the properties of the ordinary Bernoulli numbers. Recently, Victor H. Moll, Christophe Vignat and I studied an obvious generalization of the modified Bernoulli numbers, which we call "Zagier polynomials". These polynomials are also rich in structure, and we have shown that a theory parallel to that of the ordinary Bernoulli polynomials exists. Zagier showed that his asymptotic formula for B_{2n}^* can be replaced by an exact formula. In a joint work with M. L. Glasser and K. Mahlburg, we have shown that an exact formula exists for the Zagier polynomials too. It involves Chebyshev polynomials and an infinite series of Bessel function $Y_n(z)$. It will be also shown that Zagier's exact formula can be derived as a limiting case of this general formula, which is interesting in itself.

Ahmad El-Guindy (a.elguindy@gmail.com) – Taxas A&M University at Qatar

Atkin's orthogonal polynomial and associated Jacobi polynomials

Abstract: The Atkin polynomials play an important role in number theory through their connections to the Hecke Action on modular forms and to supersingular polynomials. In this talk, we discuss the connection between these polynomials and the associated Jacobi polynomials, and derive a number of new consequences and properties of them. We also investigate the q-analogue of those connections.

This talk is based on a joint work with Ismail.

Willi Freeden (freeden@mathematik.uni-kl.de) – University of Kaiserslautern

Euler Summation and Shannon Sampling

Abstract: The famous Shannon sampling theorem gives an answer to the question of how a time signal bandlimited to (a subinterval G of) the fundamental cell $F_{\mathbb{Z}}$ of the lattice $\mathbb{Z}$ can be reconstructed from discrete values in the lattice points of $\mathbb{Z}$.

In this talk, we are concerned with the problem how a space signal bandlimited to a region $G \subset \mathbb{R}^q, q \geq 2$, allows a reconstruction from discrete values in the lattice points of a (general) lattice. Weighted Hardy-Landau lattice point formulas are created to allow explicit characterizations of over- and undersampling

procedures, thereby specifying not only the occurrence, but also the type of aliasing in thorough mathematical description. An essential tool for the proof of Hardy–Landau identities in lattice point theory is the extension of the Euler summation formula to multi-dimensional second order Helmholtz-type operators involving associated Green functions with respect to the boundary condition of periodicity. In order to circumvent convergence difficulties and/or slow convergence in multi-dimensional lattice point summation, some summability methods are unavoidable, namely lattice ball and Gauss-Weierstrass averaging. As a consequence, multi-dimensional lattice sampling becomes available in the proposed summability context to accelerate the summation of the cardinal series. Finally, some aspects are indicated about constructive approximation in a resulting Paley–Wiener framework.

This talk is based on a joint work with Zuhair M. Nashed.

Frank Garvan (fgarvan@ufl.edu) – University of Florida

Transformation Properties of Dyson's Rank Function

Abstract: Let $R(z, q)$ be the two variable generating function for Dyson's rank function. Many of Ramanujan's mock theta functions can be written in terms of $R(\zeta, q)$ where ζ is a root of unity. We strengthen Ahlgren, Bringmann and Ono's results for this function as a weak Maass form.

Tim Huber (hubertj@utpa.edu) – The University of Texas Pan American

On a Level 17 analogue of the Rogers-Ramanujan Continued Fraction

Abstract: The field of functions invariant under $\Gamma_0(17)$ and the Fricke involution will be constructed in terms of a single modular parameter. This generator is a rational function of a level 17 analogue of the Rogers-Ramanujan continued fraction and an eta quotient. The construction is motivated by similar work of S. Cooper, and D. Ye at levels L in which $L - 1$ divides 24. Differential equations satisfied by weight two Eisenstein series and explicit evaluations for the level 17 generator induce new rational series approximations for π.

This is joint work with D. Schultz and D. Ye.

Christopher M. Jennings-Shaffer (cjenningsshaffer@ufl.edu) – University of Florida

A Few Exotic Bailey Slater Smallest Parts Partition Functions

Abstract: Upon revisiting the congruences for the number of smallest parts among the integer partitions of n, Andrews, Garvan, and Liang defined an spt-crank of the smallest parts function. In explaining congruences for the number of smallest parts among the overpartitions of n, Garvan and the author introduced an spt-crank for the overpartition smallest parts function. Motivated by these examples, the author has constructed many new smallest parts like functions using Bailey pairs of Slater. We look at three of these functions that come from the Bailey pairs in group J of Slater's work. We demonstrate one method of proving simple Ramanujan like congruences for these functions through careful q-series rearrangements and Bailey's Lemma.

Erik Koelink (e.koelink@math.ru.nl) – Radboud Universiteit the Netherlands

An explicit family of matrix-valued orthogonal polynomials in the q-Askey scheme

Abstract: Matrix-valued orthogonal polynomials have been introduced by Krein, and have been studied from several perspectives, such as recursion relation, orthogonality relations, link to spectral theory and moment problems, etc. We discuss an explicit family of matrix-valued orthogonal polynomials, which can be viewed as matrix-valued analogues of the Chebyshev polynomials of the second kind. These polynomials exist for arbitrary size of the matrix. Here the Chebyshev polynomials are viewed as a special cases of the Askey-Wilson polynomials or its subclass of the continuous q-ultraspherical polynomials. For the explicit family of matrix-valued orthogonal polynomials the following are discussed: orthogonality relations, matrix-valued three-term recurrence relation, matrix-valued second order q-difference operators of Askey-Wilson type and a link to scalar orthogonal polynomials from the q-Askey scheme. Apart from these properties we briefly discuss the origin of these matrix-valued orthogonal polynomials.

This is based on joint work with Noud Aldenhoven (Radboud Universiteit) and Pablo Roman (Universidad Nacional de Cordoba, Argentina).

Tom Koornwinder (`T.H.Koornwinder@uva.nl`) – University of Amsterdam

Fractional integral and generalized Stieltjes transforms for hypergeometric functions as transmutation operators

Abstract: There are essentially eight different parameter changing differential relations for Gauss hypergeometric functions which are iterates of first order differential relations. These give rise to eight different fractional integral relations for hypergeometric functions. Both the differential and the fractional integral relations can be obtained by combining suitable transmutation relations involving the Gauss differential equation with special values or asymptotics of the hypergeometric functions. It turns out that each of the eight fractional integral relations can be written in essentially the same form for each of the six different explicit solutions of the Gauss differential equation. Thus we obtain a list of 48 fractional integral relations.

Specialization of some of the fractional integral relations gives Euler type integral representations for three of the six explicit solutions. The other three explicit solutions have integral representations in the form of generalized Stieltjes transforms. These can also be understood from transmutation relations and they extend to generalized Stieltjes transforms connecting solutions of the Gauss differential equation of different parameters.

Tentatively the last part of the lecture will discuss analogues of these results for Appell hypergeometric series F_2 and related bivariate series.

Alexey Kuznetsov (`kuznetsov@mathstat.yorku.ca`) – York University, Canada

Hardy-Littlewood function: a nightmare for numerical analysts

Abstract: The function $Q(x) = \sin(x) + \sin(x/2)/2 + \sin(x/3)/3 + \sin(x/4)/4 + ...$ was introduced in 1936 by Hardy and Littlewood, who used it to construct a counter-example related to their results on Lambert summability. In 2005 this function has made a surprising appearance in the disproof of the Clark-Ismail conjecture, which is related to complete monotonicity of certain special functions. It turns out that the Clark-Ismail conjecture is true if and only if $Q(x) > -\pi/2$ for all $x > 0$, and it can be shown that $Q(x)$ is unbounded from below. The proof is non-constructive, and does not provide an explicit example of x for which $Q(x) < -\pi/2$. In this talk I will discuss various numerical methods by which I was able to find such an explicit example: $Q(8203872394818031742687.4 * \pi) = -1.5970415 < -\pi/2$.

Emily Leven (esergel@ucsd.edu) – University of California at San Diego

The Rational Shuffle Conjectures

Abstract: The classical shuffle conjecture of Haglund, Haiman, Loehr, Remmel and Ulyanov gives a combinatorial interpretation for a Macdonald eigenoperator, nabla, applied to an elementary symmetric function. This conjecture has been extended to given combinatorial interpretations for a whole family of operators applied to 1. This talk will explore the construction and some special properties of these operators.

Xin Li (xin.li@ucf.edu) – University of Central Florida

Some New Results on Bernstein-type Inequalities for a Rational Functions

Abstract: I will first review some generalizations of Bernstein inequalities in both polynomial and rational function cases and then focus on some new results on the rational version of Bernstein-type inequalities when some restrictions on zeros are imposed. These new inequalities extend the results of Malik and Govil for polynomials which are themselves improved versions of the classical Erdos-Lax and Turan inequalities.

Robert Maier (rsm@math.arizona.edu) – University of Arizona

The Ince Equation and Its Solutions

Abstract: The Ince equation is a generalization of the Lamé equation that has an extra free parameter. Like the Lamé equation, it can be expressed in many forms (algebraic, trigonometric, elliptic), and the underlying Ince differential operator is a tridiagonalizable second-order one. The Ince equation may have polynomial solutions, but their relation to the theory of orthogonal polynomials is unclear. The equation can be viewed as a quasi-exactly-solvable (QES) Schroedinger equation, the spectral theory of which has unusual algebraic aspects. We begin by reviewing the spectral theory of the (trigonometric) Ince equation, which originated with Magnus and Winkler, and which is a concrete application of Floquet theory. Ince polynomials, like Lamé polynomials, correspond to the edges of spectral bands. We go on to discuss recently found families of non-polynomial solutions that can be expressed in terms of the Gauss hypergeometric function. This includes solutions that generalize the Brioschi-Halphen-Crawford solutions of the Lamé equation, and algebraic ones that can be reduced to hypergeometric functions of finite monodromy (dihedral, octahedral, etc.).

Francisco Marcellan (pacomarc@ing.uc3m.es) – Universidad Carlos III de Madrid, Spain

Multiple Geronimus transformations

Abstract: In this talk we deal with multiple Geronimus transformations and we show that they lead, in a natural way, to discrete (non-diagonal) Sobolev type inner products. In this case, you can consider the higher order recurrence relation that these polynomials satisfy and you deduce the matrix representation associated with this recurrence relation in terms of a polynomial evaluated in a Jacobi matrix. This fact can be read in terms of Darboux transformations of band matrices. A connection with Geronimus spectral transformations for matrix orthogonal polynomials is also considered.

This is a joint work with M. Derevyagin (University of Mississipi) and J. C. Garca Ardila (Universidad Carlos III de Madrid)

Victor H. Moll (vhm@tulane.edu) – Tulane University

A collection of questions coming from the evaluation of integrals

Abstract: The lack of a universal algorithm for the evaluation of definite integrals of special functions in closed-form, has produced a variety of ingenious procedures for these evaluations. Historically these closed-forms have been saved in Tables of Integrals and they are in the background of modern symbolic packages. The quest for these closed-forms leads to interesting questions in Number Theory, Combinatorics and Algorithms. A selection of examples illustrating these connections is presented.

Martin Muldoon (muldoon@yorku.ca) – York University (Canada)

Monotonicity properties of zeros of ultraspherical polynomials

Abstract: It is well-known that, for $\lambda > -\frac{1}{2}$, the positive zeros $x_{nk}(\lambda)$ of $C_n^{(\lambda)}(x)$ are decreasing functions of λ . During the 80s and 90s, there was been considerable interest in discovering a suitable function $f(\lambda)$ such that $f(\lambda)x_{nk}(\lambda)$ is *increasing* for a range of λ-values. The "ILAC" (Ismail-Letessier-Askey conjecture), formulated about 1989, was proved in a stronger form by Elbert and Siafarikas in 1999. Similar questions arise for the positive zeros of the pseudo-ultraspherical polynomials $(-i)^n C_n^{(\lambda)}(ix)$ considered in recent work of Kathy Driver and the presenter. Refinements in the application of the Sturm comparison theorem (due mainly to D. K. Dimitrov) make it possible to streamline the proofs of some of these results.

Paul Nevai (paul@nevai.us) – STRSOH

(Some) Inequalities in Approximation Theory

Abstract: I will discuss polynomial inequalities associated with the names of A. Markov, Bernstein, Schur, and Remez, and their extraordinary but not fully unexpected impact on certain fundamental problems in approximation theory and orthogonal polynomials. I will also try to give convincing reasons why at least two of these inequalities are unfairly and incorrectly referred to as they are by those who are not as much sticklers for the truth as I've been trying to be lately.

Peter Paule (Peter.Paule@risc.uni-linz.ac.at) – Johannes Kepler University Linz, AUSTRIA

The concrete Tetrahedron for special functions

Abstract: Donald Knuth introduced a course "Concrete Mathematics" that has been taught annually at Stanford University since 1970. This course, and the accompanying book coauthored with Ron Graham and Oren Patashnik, was originally intended as an antidote to "Abstract Mathematics". In the 1990s, Doron Zeilberger's "holonomic systems approach to special functions identities" inspired a further wave in this "concrete" evolution: the development of computer algebra methods for symbolic summation, generating

functions, recurrences, and asymptotic estimates. The book "The Concrete Tetrahedron", by Manuel Kauers and the speaker, describes basic elements of this tool-box and can be viewed as an algorithmic supplement to "Concrete Mathematics" by Graham, Knuth, and Patashnik. The talk introduces to some of these methods. A major application concerns the computer-assisted evaluation of relativistic Coulomb integrals, joint work with Christoph Koutschan and Sergei Suslov.

Sarah Post (spost@hawaii.edu) – University of Hawaii

q-Rotations and Krawtchouk polynomials

Abstract: q-Krawtchouk polynomials are presented as matrix elements of q-rotation operators. The algebraic interpretation is based on the Schwinger realization of $U_q(sl_2)$ in terms of two q-oscillators. In the univariate case, the recurrence relations, eigenvalue operators and generating function arise from the algebra relations of the model. The extension to the bivariate case will also be discussed.

Igor Pritsker (igor@math.okstate.edu) – Oklahoma State University

Expected number of real zeros of random orthogonal polynomials

Abstract: We study the expected number of real zeros for random linear combinations of orthogonal polynomials. It is well known that Kac polynomials, spanned by monomials with i.i.d. Gaussian coefficients, have only $(2/\pi + o(1)) \log n$ expected real zeros in terms of the degree n. On the other hand, if the basis is given by Legendre (or more generally by Jacobi) polynomials, then random linear combinations have $n/\sqrt{3} + o(n)$ expected real zeros. We prove that the latter asymptotic relation holds universally for a large class of random orthogonal polynomials on the real line, and also give more general local results on the expected number of real zeros. (Joint work with D. S. Lubinsky and X. Xie.)

Nasser Saad (nsaad@upei.ca) – University of Prince Edward Island, Canada

Darboux transformation with applications

Abstract: We review the classical Darboux transformation and discuss some recent results related to the general linear second-order differential equations. Applications to few quantum Hamiltonians and the associated exceptional orthogonal polynomials are also discussed.

Plamen Simeonov (simeonovp@uhd.edu) – University of Houston-Downtown

Formulas and Identities for the Askey-Wilson Operator

Abstract: We derive two new versions of Coopers formula for the iterated Askey-Wilson operator. Using one of these formulas and the Leibniz rule for the iterated Askey-Wilson operator, we give new proofs of Rogers summation formula for 6-phi-5 series and Watsons transformation, a new Rodriguez type formula for the Askey-Wilson polynomials, and several summation formulas for q-series. We establish two integration by parts rules for integrals involving the iterated Askey-Wilson operator. Using one of these rules, we

derive a bivariate generating function for the Askey-Wilson polynomials and consider some applications. A generalization of the Leibniz rule for the iterated Askey-Wilson operator is also given.

This talk is based on a joint work with Prof. Mourad Ismail.

Dennis Stanton (stant001@umn.edu) – University of Minnesota

A small slice of Mourads work

Abstract: In this talk I will concentrate on a small portion of Mourads work: q-Taylor series, Askey-Wilson polynomials, associated polynomials, continued fractions, combinatorics and the Rogers-Ramanujan identities, with recent applications.

Armin Straub (astraub@illinois.edu) – University of Illinois at Urbana-Champaign

On a q-analog of the Apéry numbers

Abstract: The Apéry numbers are the famous sequence which underlies Apéry's proof of the irrationality of $\zeta(3)$. Together with their siblings, introduced by Zagier, they enjoy remarkable properties, including connections with modular forms, and have appeared in various contexts. One of their (still partially conjectural) properties is that these sequences satisfy supercongruences, a term coined by Beukers to indicate that the congruences are modulo exceptionally high powers of primes. In this talk, we introduce and discuss a q-analog of the Apéry numbers. In particular, we demonstrate that these q-analogs satisfy polynomial supercongruences.

Paul Terwilliger (terwilli@math.wisc.edu) – University of Wisconsin-Madison

Lowering-Raising Triples of Linear Transformations

Abstract: Fix a nonnegative integer d. Let $\mathbb{F}$ denote a field, and let V denote a vector space over $\mathbb{F}$ with dimension $d+1$. By a decomposition of V we mean a sequence $\{V_i\}_{i=0}^d$ of one-dimensional subspaces whose direct sum is V. Let $\{V_i\}_{i=0}^d$ denote a decomposition of V. A linear transformation $A \in \mathrm{End}(V)$ is said to lower $\{V_i\}_{i=0}^d$ whenever $AV_i = V_{i-1}$ for $1 \le i \le d$ and $AV_0 = 0$. The map A is said to raise $\{V_i\}_{i=0}^d$ whenever $AV_i = V_{i+1}$ for $0 \le i \le d-1$ and $AV_d = 0$. A pair of elements A, B in $\mathrm{End}(V)$ is called lowering-raising (or LR) whenever there exists a decomposition of V that is lowered by A and raised by B. A triple of elements A, B, C in $\mathrm{End}(V)$ is called LR whenever any two of A, B, C form an LR pair. We classify up to isomorphism the LR triples. There are six infinite families of solutions. We show that each solution A, B, C satisfies some relations that resemble the defining relations for $U_q(\mathfrak{sl}_2)$ in the equitable presentation.

Alexander Tovbis (alexander.tovbis@ucf.edu) – University of Central Florida

Asymptotics of Orthogonal Polynomials with Complex Varying Weight: Critical Point Behaviour and the Painleve Equations

Abstract: We study the asymptotics of recurrence coefficients for complex monic orthogonal polynomials

$\pi_n(z)$ with the quadratic exponential weight $\exp[N(z^2/2+tz^4/4)]$, where t is a complex number and $N \to \infty$. We consider neighborhoods of the critical points $t_0 = 1/12$, $t_1 = 1/15$ and $t_2 = 1/4$, where the subleading terms can be expressed via Painlevé transcendents. These subleading terms can become dominant near the poles of the corresponding Painlevé transcendents. We use the nonlinear steepest descent analysis for Riemann-Hilbert Problems to describe the recurrence coefficients in full neighborhoods of t_j, $j = 0, 1, 2$, including the location of the poles. We also provide the global (in the t-plane) phase diagrams, where the recurrence coefficients exhibit different asymptotic behaviors (Stokes' phenomenon).

Christophe Vignat (cvignat@tulane.edu) – Universite d'Orsay, France and Tulane University

A symbolic approach to multiple zeta values at the negative integers

Abstract: This talk will introduce symbolic computation techniques in the context of analytic continuations of the Euler-Zagier multiple zeta function at the negative integers; the case of the analytic continuation based on Raabe's identity, as recently proposed by B. Sadaoui [C. R. Acad. Sci. Paris, Ser. 1, 2014, 12-352, 977-984], will be considered. It will be shown how this symbolic approach allows to compute explicitly some contiguity identities, recurrences on the depth of the zeta values and generating functions.

Luc Vinet (luc.vinet@yahoo.com) – Universite de Montreal

A q-generalization of the Bannai–Ito polynomials and the quantum superalgebra $\mathfrak{osp}_q(1|2)$

Abstract: A q-generalization of the Bannai–Ito polynomials is presented. These basic polynomials are obtained by considering the Racah problem for the quantum superalgebra $\mathfrak{osp}_q(1|2)$. A quantum deformation of the Bannai–Ito algebra is realized by the intermediate Casimir operators entering in the Racah problem. The relation between the q-analogs of the Bannai–Ito polynomials and the q-Racah/Askey-Wilson polynomials is discussed.

This talk is based on work with Vincent X. Genest (CRM) and Alexei Zhedanov (Donetsk)

Roderick Wong (mawong@cityu.edu.hk) – City University of Hong Kong

Asymptotics and Orthogonal Polynomials

Abstract: In this talk, we review some of the methods that are now available in asymptotics, and show how they can be applied to classical and non-classical orthogonal polynomials. These include methods in asymptotic evaluation of integrals and asymptotic theory for ordinary differential equations. Also included are two newer methods, namely, the Riemann-Hilbert method and asymptotics for linear recurrences.

Ahmed Zayed (azayed@condor.depaul.edu) – Depaul University

Prolate Spheroidal Wave Functions and Reproducing-Kernel Hilbert Spaces

Abstract: In this talk we discuss the connections between the prolate spheroidal wave functions and

reproducing-kernel Hilbert spaces and their applications in signal processing, in particular in solving the energy concentration problem.

Jiang Zeng (zeng@math.univ-lyon1.fr) – University Claude Bernard Lyon 1, France

Some combinatorial aspects of 2D-Hermite polynomials and 2D-Laguerre polynomials

Abstract: We present a detailed study of a one-parameter generalization of the 2D-Hermite polynomials and two- parameter extension of Zernike's disc polynomials. We derive linear and bilinear generating functions, and explicit formulas for our generalizations and study integrals of products of some of these 2D orthogonal polynomials. Moreover, we provide a combinatorial proof of a Kibble-Slepian type formula for the 2D-Hermite polynomials, which extends the Poisson kernel for these polynomials. We also give a combinatorial model for the 2D-Laguerre polynomials and study their linearization coefficients.

This talk is based on joint work with Mourad Ismail.

Changgui Zhang (changgui.zhang@math.univ-lille1.fr) – University of Lille, France

On the Mock-Theta Behavior of Appell-Lerch Series

Abstract: The Ramanujan's mock-theta functions have a ultimate link with Appell-Lerch series. In the talk, we shall consider the Appell-Lerch series of the first order, and study its asymptotic behavior at any given unity root. It will be shown that the quotient of this series and a suitable theta function is a strong mock-theta function in the sense of G.E. Andrews and D. Hickerson.

Ruiming Zhang (ruimingzhang@yahoo.com) – Northwest A&F University, China

On Fourier Transforms and q-Special Functions

Abstract: This talk is based on an ongoing joint project with Dr. Mourad E. H. Ismail. We have obtained many formulas related to q-special functions such as $e_q(z)$, $E_q(z)$, $A_q(z)$, $S_n(x;q)$, $h_n(x|q)$, $J_\nu^{(1)}(z;q)$, $J_\nu^{(2)}(z;q)$ and $L_n^{(\alpha)}(x;q)$, and we have also investigated their asymptotics. Because of time and space limitations, I only present some of our formulas related to $e_q(z)$, $E_q(z)$, $A_q(z)$, $S_n(x;q)$, $J_\nu^{(1)}(z;q)$ and $J_\nu^{(2)}(z;q)$ instead, even for these formulas we will skip their proofs.