Talks and Posters:

Poster

Trigonometric Solutions of WDVV Equations

Maali Alkadem
University of Glasgow

Abstract: We consider trigonometric solutions of Witten-Dijkgraaf-Verlinde-Verlinde equations corresponding to configurations of vectors with multiplicities. We describe procedures of taking subsystems and restrictions in such configurations leading to new solutions including a family of BC_n type configurations. The poster is based in joint work with G. Antoniou and M.Feigin.

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Poster

Saito determinant for Coxeter discriminant strata

Georgios Antoniou
University of Glasgow

Abstract: Let W be a finite Coxeter group and V its reflection representation. On the orbit space $M = V/W$ there exists a pencil of flat metrics of which the Saito flat metric η, defined as the Lie derivative of the W-invariant form g on V is the key object. We obtain the determinant of Saito metric on the Coxeter discriminant strata in M. It is shown that this determinant in the flat coordinates of the form g is proportional to the product of linear factors associated to the root subsystem defining the discriminant stratum. We also find multiplicities of these factors in the determinant. The poster is based on joint work with M. Feigin and I. Strachan.

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Talk

Poisson cohomology of difference Hamiltonian operators

Matteo Casati
University of Kent

Abstract: The classification of Hamiltonian operators in the formal calculus of variations relies on their corresponding Poisson-Lichnerowicz cohomology. We consider the case of scalar difference Hamiltonian operators, such as the ones which constitute the biHamiltonian pair for the Volterra chain, and prove that $H^p(P) = 0$ for first order operators and $p > 1$, an analogue of Getzler's result for (differential) operators of hydrodynamic type.

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Talk

From Dunkl and Cherednik operators to Lax pairs

Oleg Chalykh
University of Leeds

Abstract: We present a direct conceptual link between elliptic Dunkl operators and Lax pairs for the elliptic Calogero-Moser model. It works both for the classical and quantum models and for all root systems, including the BC_n-case with 5 couplings (Inozemtsev system). A similar method can be applied to the elliptic Ruijsenaars model and its generalisations, where very little was known beyond the A_n-case. In particular, this allows us to calculate a Lax matrix for the van Diejen system with full 9 couplings, which was an old open problem.

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Talk

The resonant structure of Kink-Solitons in the Modified KP Equation

Jen-Hsu Chang
National Defense University, Taiwan

Abstract: Using the Wronskian representation of τ-function, one can investigate the resonant structure of kink-soliton and line-soliton of the modified KP equation. It is found that the resonant structure of the soliton graph is obtained by superimposition of the two corresponding soliton graphs of the two Le-Diagrams given an irreducible Schubert cell in a totally non-negative Grassmannian $Gr(N, M)_{\geq 0}$. Several examples are given.

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Talk

Non-Commutative double-sided continued fractions and KP maps

Adam Doliwa
University of Warmia and Mazury

Abstract: Motivated by studies of the non-Abelian Hirota-Miwa equation I plan to present non-commutative analogs of some pertinent results of the theory of continued fractions. These include, in particular, their equivalence transformations, Euler's and Galois theorems on periodic continued fractions. Moreover, the corresponding non-commutative versions of the LR- and qd-algorithms, which lead to the non-commutative discrete Toda equation, will be given.

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Talk

Quasi-Coxeter elements and algebraic Frobenius manifolds

Theo Douvropoulos
Parid Diderot, IRIF, ERC CombiTop

Abstract: Dubrovin has shown that the global structure of a (semi-simple) Frobenius manifold is determined by the Hurwitz orbit of an ordered tuple of euclidean reflections. When these orbits are finite, they generate real reflection groups and it is a theorem of Hertling that the tuples encode factorizations of a Coxeter element, precisely when the corresponding (pre)-potential is polynomial.
There is a deep interplay between the combinatorics of such factorizations and the Frobenius structure; in particular, the degree of its Lyashko-Looijenga morphism determines the size of the Hurwitz orbit. Moreover, the list of factorizations itself gives the dual-braid presentation of the corresponding Artin group (which is also the fundamental group of the complement of the discriminant of the Frobenius manifold).
The study of arbitrary tuples of reflections, but with finite Hurwitz orbit, leads to quasi-Coxeter elements and algebraic Frobenius manifolds. Few of these have been explicitly constructed yet, but they suggest that the previous results still hold. We explain what is required of the Frobenius structure for the proofs to go through, and in this way justify some very interesting numerology. On the other hand, we use these combinatorics of factorizations to propose candidates for the invariants of the prepotentials (with the aim of computationally constructing some of them).

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Talk

Discrete Painlevé Equations in Tiling Problems

Anton Dzhamay
University of Northern Colorado

Abstract: The notion of a gap probability is one of the main characteristics of a probabilistic model. Borodin showed that for some discrete probabilistic models of Random Matrix Type discrete gap probabilities can be expressed through solutions of discrete Painlevé equations, which provides an effective way to compute them. We discuss this correspondence for a particular class of models of lozenge tilings of a hexagon. For uniform probability distribution, this is one of the most studied models of random surfaces. Borodin, Gorin, and Rains showed that it is possible to assign a very general elliptic weight to the distribution and degenerations of this weight correspond to the degeneration cascade of discrete polynomial ensembles, such as Racah and Hahn ensembles and their q-analogues. This also correspond to the degeneration scheme of discrete Painlevé equations, due to the work of Sakai. Continuing the approach of Knizel, we consider the q-Hahn and q-Racah ensembles and corresponding discrete Painlevé equations of types $q-P(A2)$ and $q-P(A(1))$. We show how to use the algebro-geometric techniques of Sakai's theory to pass from the isomonodromic coordinates of the model to the discrete Painlevé coordinates that is compatible with the degeneration. This is joint with Alisa Knizel.

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Talk

Autonomous limits of matrix Painlevé II equations and their Bäcklund transformations.

Yuri Fedorov
Polytechnic university of Catalonia (UPC), Barcelona

Abstract: Autonomous limits of matrix Painlevé equations turn out to be an ample source of new and classical finite-dimensional integrable systems. In this talk I present a Lax representation of the autonomous limit of nxn matrix P II, show that the system is completely integrable in the non-commutative sense, and identify the complex invariant tori of the system as Prym varieties of the spectral curve. This enables one to give an explicit solution in terms of theta-functions.
In the simplest case n=2 the system yields a new integrable generalization of the Henon-Heiles system with an inverse square potential.
A family of Bäcklund transformations will be described by means of an intertwining relation (discrete Lax pair), and it will characterised explicitly as a translation of the Prym variety.
The talk is based on a work in collaboration with Andrew Pickering.

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Talk

First Integrals from Conformal Symmetries: Darboux-Koenigs Metrics and Beyond

Allan Fordy
University of Leeds

Abstract: On spaces of constant curvature, the geodesic equations automatically have higher order integrals, which are just built out of first order integrals, corresponding to the abundance of Killing vectors. This is no longer true for general conformally flat spaces, but in this case there is a large algebra of *conformal* symmetries.
In this talk I introduce method which uses these conformal symmetries to build higher order integrals for the geodesic equations. In 2 degrees of freedom this approach gives a new derivation of the Darboux-Koenigs metrics, which have only *one* Killing vector, but two quadratic integrals. In 3 degrees of freedom, the method is used to construct super-integrable Hamiltonians, depending on 3 parameters and having a single first order integral (Killing vector). Specialising the parameters introduces a higher degree of symmetry, with the resulting Hamiltonians possessing 3 first order integrals. This allows the full Poisson algebra of integrals to be constructed. These Hamiltonians are a natural generalisation of the Darboux-Koenigs systems. The first order integrals are used to reduce to 2 degrees of freedom, giving Darboux-Koenigs kinetic energies with the addition of potential functions, still super-integrable, but now in 2 degrees of freedom.

Allan P. Fordy, First Integrals from Conformal Symmetries: Darboux-Koenigs Metrics and Beyond, arXiv:1804.06904
Allan P. Fordy and Qing Huang,Generalised Darboux-Koenigs Metrics and 3 Dimensional Super-Integrable Systems, arXiv:1810.13368.

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Talk

Canonical Spectral Coordinates for Calogero-Moser Spaces

Tamás Görbe
University of Leeds

Abstract: We apply Hamiltonian reduction to obtain a simple proof of Sklyanin's formula, which provides canonical spectral coordinates on the standard Calogero-Moser space as well as the more general Calogero-Moser spaces attached to cyclic quivers.1810.13368.

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Talk

Soliton scattering in the hyperbolic relativistic Calogero-Moser system

Martin Hallnas
Chalmers University of Technology

Abstract: Integrable N-particle systems of relativistic Calogero-Moser type were first introduced by Ruijsenaars and Schneider (1986) in the classical- and Ruijsenaars (1987) in the quantum case. In the hyperbolic regime they are closely related to several soliton equations, in particular the sine-Gordon equation.
In this talk, I will focus on the quantum case and discuss a proof of the long-standing conjecture that the particles in the relativistic Calogero-Moser system of hyperbolic type exhibit soliton scattering, i.e. conservation of momenta and factorization of scattering amplitudes.
The talk is based on joint work with Simon Ruijsenaars.

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Talk

Soliton solutions of noncommutative Anti-Self-Dual Yang-Mills equations

Masashi Hamanaka
Nagoya University

Abstract: We discuss exact soliton solutions of Anti-Self-Dual Yang-Mills equations on noncommutative spaces in four-dimension. We construct them by using the Darboux transformations. Generated solutions are represented by quasideterminants of Wronski matrices in compact forms. Scattering process of the N-soliton solutions is also discussed.
This is based on collaboration with Claire Gilson and Jon Nimmo (Glasgow).

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Talk

Indicators of Integrability and Lattice Equations.

Jarmo Hietarinta
University of Turku

Abstract: There may be different opinions on the *definition* of integrability but there is more of a consensus on which properties any integrable system should have. For lattice equations some accepted necessary properties include low algebraic entropy and multidimensional consistency. We will take a closer look at these for the equations defined on the 2D Cartesian lattice.

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Talk

Cluster realizations of Weyl groups and their applications

Rei Inoue
Chiba University

Abstract: For symmetrizable Kac-Moody Lie algebra g and an integer m bigger than one, we define a weighted quiver Q, such that the cluster modular group for Q contains the Weyl group of g. It has a several interesting applications, and in this talk we introduce: (1) When g is of finite type, green sequences and the cluster Donaldson-Thomas transformation for Q are systematically obtained. (2) When g is of classical finite type and m is the Coxeter number of g, the quiver Q is related to the cluster realization of the quantum group studied by Schrader-Shapiro and Ip.
This talk is based on a joint work with Tsukasa Ishibashi and Hironori Oya.

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Talk

Linkage mechanisms governed by integrable deformations of discrete space curves

Kenji Kajiwara
Kyushu University

Abstract: A linkage mechanism consists of rigid bodies assembled by joints which can be used to translate and transfer motion from one form in one place to another. In this paper, we are particularly interested in a family of spacial linkage mechanisms which consist of n-copies of a rigid body joined together by hinges to form a ring. Each hinge joint has its own axis of revolution and rigid bodies joined to it can be freely rotated around the axis. The family includes the famous threefold symmetric Bricard6R linkage also known as the Kaleidocycle, which exhibits a characteristic "turning over" motion. We can model such a linkage as a discrete closed curve in R^3 with a constant torsion up to sign. Then, its motion is described as the deformation of the curve preserving torsion and arc length. We describe certain motions of this object that are governed by the semi-discrete mKdV equations, where infinitesimally the motion of each vertex is confined in the osculating plane. This is a joint work with Shuzo Kaji and Hyeongki Park.

Poster

Boussinesq-type lattice equations as reductions of Toda hierarchy

Saburou Kakei
Rikkyo University

Abstract: Boussinesq-type lattice equations (lattice BSQ, lattice Schwarzian BSQ) are investigated from the viewpoint of the Toda hierarchy. We will discuss algebro-geometric solutions for the equations.

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Talk

Asymptotics of discrete β-corners processes via two-level discrete loop equations

Alisa Knizel
Columbia University

Abstract: We introduce and study stochastic particle ensembles which are natural discretizations of general β-corners processes. We prove that under technical assumptions on a general analytic potential the global fluctuations for the difference between two adjacent levels are asymptotically Gaussian. The covariance is universal and remarkably differs from its counterpart in random matrix theory. Our main tools are certain novel algebraic identities that are two-level analogues of the discrete loop equations. Based on joint work with Evgeni Dimitrov (Columbia University).

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Talk

Combinatorial Fock space and representations of quantum groups at roots of unity

Martina Lanini
Università degli Studi di Roma "Tor Vergata"

Abstract: The classical Fock space arises in the context of mathematical physics, where one would like to describe the behaviour of certain configurations with an unknown number of identical, non-interacting particles. By work of Leclerc and Thibon, it(s q-analogue) has a realisation in terms of the affine Hecke algebra of type A and it controls the representation theory of the corresponding quantum group at a root of unity. In joint work with Arun Ram and Paul Sobaje, we produce a generalisation of the q-Fock space to all Lie types. This gadget can also be realised in terms of affine Hecke algebra and captures decomposition numbers for quantum groups at roots of unity.

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Poster

Applications of quasideterminants in noncommutative integrable systems

Chun-Xia Li
Capital Normal University

Abstract: In literature, some well-known integrable systems are generalized to their noncommutative versions. Quasideterminant solutions to the corresponding noncommutative integrable systems are constructed and analyzed. As a remarkable result, we proposed a kind of twisted derivation and constructed its gauge transformation. This result makes it possible to contruct Darboux transformations and quasideterminant solutions to the known noncommutative KP, two-dimensional Toda lattice equation, the Hirota-Miwa equation and even the supersymmetric KdV equation due to the existence of odd dependent variables. Far from this, we are able to construct quasideterminant solutions to the noncommutative q-difference two-dimensional Toda lattice equation. This poster will try to summarize and report the recent progress of applications of quasideterminants in commutative integrable systems.

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Talk

Multiple orthogonal polynomials living on a star

Ana F. Loureiro
University of Kent

Abstract: At the centre of the discussion are sequences of polynomials satisfying higher order recurrence relations with all recurrence coefficients, except the last one, equal to zero. The polynomials at issue are orthogonal with respect to a vector of measures, are rotational invariant and all the zeros lie on a star in the complex plane. The main focus will be on those with a classical behaviour. This talk will also include the ratio asymptotic behaviour as well as the zero limit distribution. Some of these polynomials systems appeared in the theory of random matrices, in particular in the investigation of singular values of products of Ginibre matrices.

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Talk

An integrable discretization of the complex WKI equation and numerical computation of a vortex filament

Kenichi Maruno
Waseda University

Abstract: The complex WKI (Wadati-Konno-Ichikawa) equation is transformed into the local induction equation for a vortex filament by a hodograph transformation. We discretize the complex WKI equation and propose an integrable self-adaptive moving mesh scheme for the motion of a vortex filament. We perform numerical computations by using our self-adaptive moving mesh scheme and confirm that our self-adaptive moving mesh scheme is accurate compared to the standard numerical scheme for the motion of a vortex filament.

Poster

A difference equation connecting integrable and chaotic mappings

Atsushi Nagai
Tsuda University

Abstract: A difference equation equipped with a parameter c is proposed. This equation connects chaotic mapping and integrable mapping by changing the value c. Time evolutions are investigated in a detailed manner. The corresponding bifurcation diagram, which has a self-similarity, is also shown. This is a joint work with Hiroko Yamaki and Kana Yanuma.

Talk

Darboux and Moutard transformations - What I learned from Jon

Masatoshi Noumi
Kobe University, Kobe, Japan

Abstract: I will give an overview of Darboux/Moutard transformations and their iterations for Hirota/Miwa equations, on the basis with a collaboration with Jon Nimmo.

Talk

Dark soliton solutions for toroidal type soliton equations

Yasuhiro Ohta
Kobe University

Abstract: Dark soliton solutions are constructed in determinant form for some soliton equations with toroidal Lie algebra symmetry. There are two types of determinant expressions of tau functions, Wronskian and Grammian, both of which have arbitrary functions of toroidal variables in their components. The profile of each soliton is controlled by these functions.

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Talk

Painlevé-Calogero correspondence: The elliptic 8-parameter level

Simon Ruijsenaars
University of Leeds, School of Mathematics

Abstract: The 8-parameter elliptic Sakai difference Painlevé equation [2] admits a Lax pair formulation. We sketch how a suitable specialization of one of the Lax equations gives rise to the time-independent Schrödinger equation for the BC1 8-parameter relativistic Calogero-Moser Hamiltonian due to van Diejen [3]. This amounts to a generalization of previous results concerning the Painlevé-Calogero correspondence to the highest level of the two hierarchies. This talk is based on joint work with M. Noumi and Y. Yamada [1].

1. M. Noumi, S. Ruijsenaars and Y. Yamada, The elliptic Painlevé Lax equation vs. van Diejen's 8-coupling elliptic Hamiltonian, arXiv:1903.09738.
2. H. Sakai, Rational surfaces associated with affine root systems and geometry of the Painlevé equations, Commun. Math. Phys. 220 (2001), 165–229.
3. J. F. van Diejen, Integrability of difference Calogero-Moser systems, J. Math. Phys. 35 (1994), 2983–3004.

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Talk

Nonlinear Discrete Models for Traffic Flow

Junkichi Satsuma
Musashino University

Abstract: Two nonlinear discrete model for traffic flow are discussed. One is a simple nonintegral model and the other is an exactly solvable model. Both are reduced to Burgers' equation in certain limits.

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Talk

On an integrable multi-dimensionally consistent 2n+2n-dimensional heavenly-type equation

Wolfgang Schief
The University of New South Wales, Sydney, Australia

Abstract: Based on the commutativity of scalar vector fields, an algebraic scheme is presented which leads to a privileged multi-dimensionally consistent 2n+2n-dimensional integrable partial differential equation with the associated eigenfunction constituting an infinitesimal symmetry. The "universal" character of this novel equation of vanishing Pfaffian type is demonstrated by retrieving and generalising to higher dimensions a great variety of well-known integrable equations such as the dispersionless KP and Hirota equations and various avatars of the heavenly equation governing self-dual Einstein spaces.

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Talk

Discrete integrable systems associated with Z_N-graded Lax pairs and related Darboux transformations

Ying Shi
Zhejiang University of Science and Technology

Abstract: Darboux transformations are presented for a novel class of two-dimensional discrete integrable systems proposed by Fordy and Xenitidis [J. Phys. A: Math. Theor. **50** (2017) 165205] within the framework of $\mathbb{Z}_{\mathcal{N}}$-graded discrete Lax pairs.
This is realised by considering the associated linear problems for the bilinear formalism of the Fordy–Xenitidis lattice models.
We show that all these novel discrete equations share a unified solution structure in our scheme.

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Poster

Variational symmetries and Lagrangian multiforms

Duncan Sleigh
University of Leeds

Abstract: By considering the closure property of a Lagrangian multiform as a conservation law, we use Noether's theorem to show that every variational symmetry of a Lagrangian has a corresponding a Lagrangian multiform. In doing so, we provide a systematic method for constructing Lagrangian multiforms and explain how the closure property and the multiform Euler-Lagrange (EL) equations are related. We use this construction to find the first known example of a Lagrangian 3-form (a multiform for the KP equation).

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Poster

Growth of Values of Binary Quadratic Forms and Conway Rivers

Katie Spalding

Abstract: In 1997, Conway introduced a new topographical way to study the values of binary quadratic forms. We study the growth of these values on the Conway tree and compare it with the growth of the celebrated Markov numbers. The Conway river, separating on the topograph the positive and negative values of the indefinite quadratic form, is shown to play special role here. K. Spalding, A.P. Veselov, Growth of values of binary quadratic forms and Conway rivers. Bull. LMS, 50:3 (2018), 513-528.

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Poster

Singularity confinement in delay-differential Painlevé equations: a view to geometric interpretation

Alexander Stokes
UCL

Abstract: There have been several examples of delay-differential equations (which involve shifts and derivatives with respect to the same independent variable) proposed as analogues of the Painlevé equations. The story of these so far runs along similar lines to that of discrete Painlevé equations, and it is natural to ask whether this analogy extends as far as a kind of geometric framework, in the spirit of Sakai's scheme [1].
Discrete Painlevé equations are second-order difference equations, examples of which were initially discovered as non-autonomous versions of Quispel-Roberts-Thompson maps [2, 3], which are solved in terms of elliptic functions. The deautonomisation was performed by enforcing a singularity confinement condition, which is closely related to the fact that discrete Painlevé equations are regularised by blowups and blowdowns of algebraic surfaces, which is key to Sakai's geometric framework.
We study an example proposed by Quispel, Capel and Sahadevan [4], which in a limiting case has a family of elliptic function solutions, and has been observed to exhibit some singulariy confinement behaviour. We present new results concerning the singularity structure of this equation, in particular that it admits an infinite family of singularity patterns beginning at the same singular value. These observations reveal the jump in complexity of singularity structures that occurs when moving from discrete to delay-differential equations, and we discuss why the algebraic geometry of rational surfaces is not enough to provide a geometric framework for Painlev é equations in the delay-differential setting.

1. H. Sakai, Rational surfaces associated with affine root systems and geometry of the Painlevé equations, Commun. Math. Phys. 220 : 165-229 (2001).
2. G.R.W. Quispel, J.A.G. Roberts and C.J. Thompson, Integrable mappings and soliton equations, Phys. Lett. A 126 : 419-421 (1988).
3. G.R.W. Quispel, J.A.G. Roberts and C.J. Thompson, Integrable mappings and soliton equations II. Phys. D 34: 183-192 (1989)
4. G.R.W. Quispel, H.W. Capel and R. Sahadevan, Continuous symmetries of differential-difference equations: the Kac-van Moerbeke equation and Painlevé reduction. Phys. Lett. A 170 :379-383 (1992).

Talk

Dunkl-Supersymmetric Orthogonal Polynomials

Satoshi Tsujimoto
University of Kyoto

Abstract: We consider the eigenvalue problem associated with the Dunkl-type differential operator (in which the reflection operator R is involved) in the context of supersymmetric quantum mechanical models. By solving this eigenvalue problem with the help of known exactly solvable potentials, we construct several classes of polynomial systems satisfying certain orthogonality relations.

Talk

On polynomial tau-functions of multi-component type hierarchies

Johan van de Leur
Utrecht University

Abstract: In a recent paper Victor Kac and I constructed all polynomial tau-functions of the 1-component KP hierarchy, namely, we showed that any such tau-function is obtained from a Schur polynomial $s_\lambda(t)$ by certain shifts of arguments. This approach can be generalized to the s-component KP hierarchy, using the s-component boson-fermion correspondence, finding thereby all its polynomial tau-functions
We also find all polynomial tau-functions for the reduction of the s-component KP hierarchy, associated to any partition consisting of s positive parts.
This is work with V. Kac.

Talk

Bispectral dual difference equations for the quantum Toda chain with boundary perturbations

Jan Felipe van Diejen
Universidad de Talca

Abstract: Hyperoctahedral Whittaker functions—diagonalizing an open quantum Toda chain with one-sided boundary potentials of Morse type—are shown to satisfy a dual system of difference equations in the spectral variable.This extends a well-known bispectral duality between the non-perturbed open quantum Toda chain and a strong-coupling limit of the rational Macdonald-Ruijsenaars difference operators. It is manifest from the difference equations in question that the hyperoctahedral Whittaker function is entire as a function of the spectral variable. (Based on work in collaboration with Erdal Emsiz.)

Talk

Geometrisation and integrability

Alexander Veselov
Loughborough University

Abstract: Given a manifold, can one introduce a "good metric" on it, and if yes, in "how many ways"? This is one of the informal versions of the general geometrisation programme, going back to Riemann, Klein and Poincare, but still attracting a substantial interest of geometers. In dimension 2 we have the celebrated Uniformisation theorem, closely related to the theory of the automorphic functions.
In dimension 3 we have the famous Thurston's geometrisation conjecture proved by Perelman, which became one of the major mathematical events of our time. This example shows also that giving the precise definition of good metric could be the key part of the question.
From the point of view of the theory of integrable systems the question looks quite natural, if one understands a good metric in the sense of the integrability of the corresponding geodesic flow. I will demonstrate the importance of this point of view both for geometry and for the theory of integrable systems.
The talk will be partly based on the recent joint work with Alexey Bolsinov and Yiru Ye.

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Talk

The reflection equation and quantized pseudo-fixed-point subalgebras

Bart Vlaar
Heriot-Watt University

Abstract: Let g be a finite-dimensional simple complex Lie algebra and let k be the fixed-point subalgebra of an involutive automorphism of g. Certain coideal subalgebras $U_q(k)$ of the quantized enveloping algebra $U_q(g)$ can be considered the natural q-analogues of k. Many of these were found in the 1990s by Noumi, Sugitani and Dijkhuizen using well-chosen matrix solutions of the reflection equation (braid relation of type B). Later Letzter completely classified these quantized fixed-point subalgebras. More recently Balagović and Kolb showed that $U_q(k)$ is a quasitriangular coideal subalgebra; in particular, associated to $U_q(k)$ there is a universal solution of the reflection equation.
This story can be told in a more general setting. Roughly speaking, a pseudo-fixed-point subalgebra of g is a subalgebra k which intersects the root spaces of g in the same way as the fixed-point subalgebra of an involution of g. This includes some non-reductive subalgebras k. For all such k there exists a quasitriangular coideal subalgebra $U_q(k)$ of $U_q(g)$ and we conjecture that all quasitriangular coideal subalgebras of $U_q(g)$ arise in this way. We indicate in how far these statements generalize to (quantized) Kac-Moody Lie algebras, in particular those of affine type which are relevant to quantum integrability in the presence of a boundary. Joint work with V. Regelskis (arXiv:1807.02388 and in progress).

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Poster

Intertwining operator for AG_2 Calogero–Moser–Sutherland system

Martin Vrabec
University of Glasgow

Abstract: We consider a generalised Calogero–Moser–Sutherland quantum Hamiltonian H associated with a configuration of vectors AG_2 on the plane which is a union of A_2 and G_2 root systems. The Hamiltonian H depends on one parameter. We find an intertwining operator between H and the Calogero–Moser–Sutherland Hamiltonian for the root system G_2. This gives a quantum integral for H of order 6 in an explicit form thus establishing integrability of H. The poster is based on joint work with M. Feigin.

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Talk

Wave fronts and cascades of soliton interactions in the periodic two dimensional Volterra system

Jing Ping Wang
University of Kent

Abstract: In this talk, we discuss the recent development of the dressing method for the solution of the two-dimensional periodic Volterra system with a period N . We derive soliton solutions of arbitrary rank k and give a full classification of rank 1 solutions. The new class of exact solutions corresponding to wave fronts represents the smooth interfaces between two nonlinear periodic waves or a periodic wave and a trivial (zero) solution. The wave fronts are non-stationary and they propagate with a constant average velocity. This system also has soliton solutions similar to breathers, which resembles soliton webs in the KP theory. We associate the classification of such solutions with the Schubert decomposition of the Grassmannians.
This is the joint work with R. Bury and A.V. Mikhailov.

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Talk

Solution to the direct and inverse scattering problems for the ultradiscrete KdV equation

Ralph Willox
University of Tokyo

Abstract: We solve the direct scattering problem for the ultradiscrete Korteweg de Vries equation over the real numbers, for any potential with compact support, by explicitly constructing bound state and non-bound state eigenfunctions. We then show how to reconstruct the potential in the scattering problem at any time, using an ultradiscrete analogue of a Darboux dressing transformation, based on data uniquely characterising the soliton content and a 'background'. These data are obtained from the initial potential by Darboux undressing transformations.

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Talk

Schubert calculus and quantum integrability

Paul Zinn-Justin
The University of Melbourne

Abstract: We report on recent progress in the field of Schubert calculus, a classical branch of enumerative geometry, and its recently uncovered relation to quantum integrable systems. We shall see how the latter provide many explicit combinatorial formulae ("puzzle rules") for intersection numbers for partial flag varieties, and their generalizations (e.g. in equivariant K-theory). We shall also discuss the connection with the work of Okounkov et al on quantum integrable systems and the equivariant cohomology of Nakajima quiver varieties. This is joint work with A. Knutson (Cornell).

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