ICFT 2014

18th UK Meeting on Integrable Models, CFT & Related Topics

School of Mathematics & Statistics, University of Glasgow

	Friday, 11 April 2014	**Location**
13:30	*Registration and refreshments*	Common Room
14:00	**O'Connell** Randomness and integrable systems	Maths 515
15:00	**Adamopoulou** Bethe Ansatz equations and the classical $A_2^{(1)}$ Toda field theory	Maths 515
15:30	**Szecsenyi** One-point functions in finite volume/temperature	Maths 515
16:00	*Coffee and posters*	Common Room
16:30	**Ruijsenaars** A recursive construction of joint eigenfunctions for the commuting hyperbolic Calogero-Moser Hamiltonians	Maths 515
17:30	**Discussion time and posters**	Common Room
20:00	*Dinner at Balbir's*	Church St
	Saturday, 11 April 2014	
09:30	**Pasquier** Bethe Ansatz for the open PASEP	Maths 515
10:30	*Coffee and posters*	Common Room
11:00	**Iles** Characters of the W3 algebra	Maths 515
11:30	**Regelskis** Drinfel'd basis of twisted Yangians	Maths 515
12:00	**Lechtenfeld** Nonlinear supersymmetry in the quantum Calogero model	Maths 515
13:00	*End of workshop*	
Posters		
	Lencses Renormalized truncated conformal space approach for the scaling three-state Potts model	Common Room
	Hallnäs A product formula for the eigenfunctions of a quartic oscillator	Common Room
	Pei Robinson-Schensted Algorithms	Common Room
	Willetts Spin Chains, Vertex Operators and Form-Factors	Common Room

Titles & Abstracts

Panagiota Adamopoulou (University of Kent)

Bethe Ansatz equations and the classical $A_2^{(1)}$ Toda field theory

We discuss a connection between the classical and quantum versions of the (1+1)-dimensional affine Toda field theories (ATFTs). We show that the connection coefficients for specific solutions of the linear problem associated to the classical ATFT of type $A_2^{(1)}$ satisfy certain functional relations [1]. This way we enlarge the so-called ODE/IM correspondence [2].

References
[1] P. Adamopoulou, C. Dunning: Bethe Ansatz equations for the classical $A_n^{(1)}$ affine Toda field theories, arXiv:1401.1187 [math-ph]
[2] P. Dorey, C. Dunning, R. Tateo: The ODE/IM Correspondence, J.Phys.A40:R205-R283 (2007)

Martin Hallnäs (Loughborough University) - Poster

A product formula for the eigenfunctions of a quartic oscillator

We consider the Schrodinger operator on the real line with an even quartic potential. Our main result is a product formula which expresses the product of two eigenfunctions corresponding to the same eigenvalue, but depending on different variables, as an integral of one eigenfunction against a certain kernel function. The kernel function is given explicitly in terms of an Airy function, and is positive for appropriate parameter values. Such a product formula can be viewed in various ways. For instance, it can be regarded as an integral equation for the eigenfunctions after a suitable choice of one of the variables. One could also try to tie in the product formula with the harmonic analysis of expansions in the eigenfunctions.

A detailed account of the results is provided in a recent joint paper with Edwin Langmann, see arXiv:1312.3493.

Nick Iles (King's College London)

Characters of the W3 algebra

http://arxiv.org/abs/1307.3771

Traces of powers of the zero mode in the W3 Algebra have recently been found to be of interest, for example in relation to Black Hole thermodynamics, and arise as the terms in an expansion of the full characters of the algebra. We calculate the first few such powers in two cases. Firstly, we find the traces in the 3-state Potts model by using null vectors to derive modular differential equations for the traces. Secondly, we calculate the exact results for Verma module representations. We compare our two methods with each other and the result of brute-force diagonalisation for low levels and find complete agreement.

Olaf Lechtenfeld (Leibniz Universitat Hannover)

Nonlinear supersymmetry in the quantum Calogero model

It is long known that the rational Calogero model describing n identical particles on a line with inverse-square mutual interaction potential is quantum superintegrable. We review the (nonlinear) algebra of the conserved quantum charges and the intertwiners which relate the Liouville charges at couplings g and g+1. For integer values of g, these intertwiners give rise to additional conserved charges commuting with all Liouville charges and known since the 1990s. We give a direct construction of the unique such charge totally antisymmetric under particle permutations. It is of order n(n-1)(2g-1)/2 in the momenta and squares to a polynomial in the Liouville charges. With a natural Z_2 grading, this charge extends the algebra of conserved charges to a nonlinear supersymmetric one. We provide explicit expressions for intertwiners, charges and their algebra in the cases of two, three and four particles.

Mate Lencses (Eotvos University) - Poster

Renormalized truncated conformal space approach for the scaling three-state Potts model

The truncated conformal space approach (TCSA) is a nonperturbative method for perturbed conformal field theories in two dimensions invented by Yurov and Zamolodchikov. Truncating the conformal Hilbert space to states below a given energy cut-off, the Hamiltonian can be diagonalized numerically in finite volume. Increasing the cut-off one hopes that the results converge to the exact ones; however, the convergence can be slow and in certain cases the method gives divergent results. Using the renormalization group proposed by G. Watts et al. one can extract infinite cut-off quantities from relatively low cut-off TCSA data to a surprisingly high precision. We perform this renormalization procedure in the case of the scaling three-state Potts model. The extrapolated results for energy levels are compared against excited state thermodynamic Bethe Ansatz calculations.

Neil O'Connell (Trinity College Dublin & University of Warwick)

Randomness and integrable systems

How does one introduce randomness into a classical dynamical system in order to produce something which is related to the 'corresponding' quantum system? I will discuss this question from a probabilistic point of view, in the context of some integrable Hamiltonian systems.

Vincent Pasquier (CEA Saclay)

Bethe Ansatz for the open PASEP

I will explain how the current fluctuations of the open ASEP (asymetric exclusion process) are related to a certain eigenvalue of an open XXZ chain whose boundaries violate spin conservation. This will lead me to introduce a kind of QP matrix whose factorization and decomposition properties enable to obtain Bethe equations which can be solved for this specific eigenvalue.

Yuchen Pei (University of Warwick) - Poster

Robinson-Schensted Algorithms

In this poster we present a q-weighted version of the Robinson-Schensted (column insertion) algorithm which is closely connected to q-Whittaker functions (or Macdonald polynomials with t=0) and reduces to the usual Robinson-Schensted algorithm when q=0. The q-insertion algorithm is `randomised', or `quantum', in the sense that when inserting a positive integer into a tableau, the output is a distribution of weights on a particular set of tableaux which includes the output which would have been obtained via the usual column insertion algorithm. There is also a notion of recording tableau in this setting. We show that the distribution of weights of the pair of tableaux obtained when one applies the q-insertion algorithm to a random word or permutation takes a particularly simple form and is closely related to the q-Whittaker functions. In the case $0 \leq q < 1$, the q-insertion algorithm applied to a random word also provides a new framework for solving the q-TASEP interacting particle system introduced (in the language of q-bosons) by Sasamoto and Wadati (1998). We also show that this algorithm has a symmetry property analogous to the well-known symmetry property of the normal Robinson-Schensted algorithm. The proof uses a generalisation of the growth diagram approach introduced by Fomin (1979, 1986, 1994, 1995).

Based on arXiv:1212.6716, 1306.2208

Vidas Regelskis (University of Surrey)

Drinfel'd basis of twisted Yangians

Twisted Yangians in the RTT-formalism were introduced by G. Olshanskii twenty years ago and since then have played a major role in quantum integrable models with open boundary conditions. In this talk I will present Drinfel'd basis of twisted Yangians. In this approach twisted Yangians emerge as a quantization of the Lie bi-ideal structure for twisted half-loop algebras of finite dimensional simple complex Lie algebras, and are of a uniform form for all symmetric pairs of simple Lie algebras and for simple twisted even half-loop Lie algebras. As an example, I will show the explicit form of twisted Yangians in Drinfel'd basis for the sl3 Lie algebra. (The talk is based on the preprint arXiv:1401.2143)

Simon Ruijsenaars (University of Leeds)

A recursive construction of joint eigenfunctions for the commuting hyperbolic Calogero-Moser Hamiltonians

We present a recursive scheme that yields an explicit diagonalisation of the hyperbolic N-particle Calogero-Moser quantum systems of nonrelativistic and relativistic type. For the nonrelativistic case, the first step of the scheme yields the well-known 2-particle eigenfunction, which amounts to a specialization of the Gauss hypergeometric function. The work on the N>2 case (together with Martin Hallnäs) gives rise to an elementary representation of the joint eigenfunctions previously obtained (for root system A_{N-1}) by Heckman and Opdam. Last but not least, we briefly sketch a similar recursive construction for the joint eigenfunctions of the 2N commuting relativistic Calogero-Moser Hamiltonians.

Istvan Szecsenyi (Durham University)

One-point functions in finite volume/temperature

We consider finite volume (or equivalently, finite temperature) expectation values of local operators in integrable quantum field theories using a combination of numerical and analytical approaches. It is shown that the low-temperature expansion proposed by Leclair and Mussardo, and its generalization to excited states proposed by Pozsgay, that are using thermodynamic Bethe Ansatz and form factor techniques can be matched with high precision by the truncated conformal space approach, when supplemented with renormalization group. Besides verifying the consistency of the two descriptions, their combination leads to an evaluation of expectation values which is valid to a very high precision for all volume/temperature scales.

arXiv:1304.3275

Jennifer Willets (Heriot-Watt University) – Poster

Spin Chains, Vertex Operators and Form-Factors

One-dimensional Heisenberg spin chains can be used to model certain quasi-one-dimensional materials. Using the vertex operator approach due to Jimbo and Miwa, it is possible to compute exact results for correlation functions of the spin-1/2 XXZ chain and so calculate the dynamic structure factors of these materials - objects measurable in inelastic neutron scattering experiments. I hope to give an overview of the techniques involved and briefly talk about our application of this approach in the spin-1 case, the goal of which being to compute exact form-factors.

List of Participants

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Directions to the Restaurant

Balbir's, 7 Church Street, Glasgow G11 5JP

Friday, 11 April, 20:00