BAXTER 2015

Exactly Solved Models & Beyond

Program

Palm Cove, Queensland, Australia,
19 – 25 July, 2015

BAXTER 2015

Exactly Solved Models & Beyond

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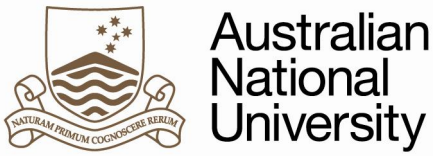
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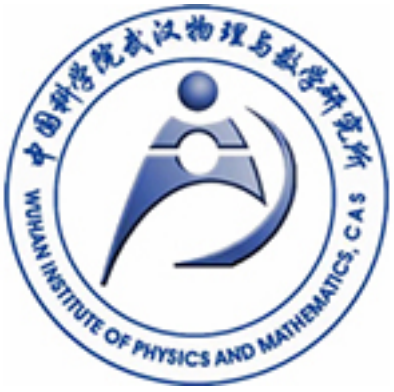
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Exactly Solved Models and Beyond

Monday 20 July 2015

TIME	
9:00 am	**Michio Jimbo**: Quantum toroidal algebras and Bethe ansatz
9:45 am	**Tony Guttmann**: Sorting with two stacks and quarter-plane loops
Morning Tea: 10:30 — 11:00 am	
11:00 am	**Craig Tracy**: A Bethe Ansatz approach to ASEP
11:45 am	**Rinat Kashaev**: Quantum dilogarithm and exactly solved models of TQFT
Lunch: 12:30 — 2:00 pm	
2:00 pm	**Paul Pearce**: Fused RSOS models as higher-level nonunitary minimal models
2:30 pm	**Benjamin Basso**: Structure Constants and Integrable Bootstrap in Planar $N = 4$ SYM Theory
3:00 pm	**Patrick Dorey**: Form factor relocalisation
Afternoon Tea: 3:30 – 4:00 pm	
4:00 pm	**Junji Suzuki**: Fused RSOS models as higher-level nonunitary minimal models
4:30 pm	**Jon Links**: Electron–hole asymmetry of the p+ip pairing model
5:00 pm	**Giuliano Niccoli**: From the exact characterization of the spectrum of quantum integrable models towards their exact dynamics by separation of variables

Exactly Solved Models and Beyond

Tuesday 21 July 2015

TIME	
9:00 am	**George Andrews**: Intriguing questions from Rodney Baxter that changed my life
9:45 am	**Rodney Baxter**: Some academic and personal reminiscences of Rodney James Baxter
Morning Tea: 10:30 — 11:00 am	
11:00 am	**Peter Forrester**: Exact results for random matrices
11:45 am	**Sergei Lukyanov**: Fidelities in the spin-boson model
Lunch: 12:30 — 2:00 pm	
2:00 pm	**Ole Warnaar**: An identity in search of a Baxter
2:30 pm	**Angela Foerster**: Exactly solved models in physics
3:00 pm	**Masahito Yamazaki**: TBA
Afternoon Tea: 3:30 – 4:00 pm	
4:00 pm	**Hermann Boos**: Application of the hidden fermionic structure to the CFT
4:30 pm	**Inna Lukyanenko**: An integrable case of the $p + ip$ pairing Hamiltonian interacting with its environment
4:50 pm	**Andrew Kels**: New solutions of the star-triangle relation with discrete and continuous spin variables
5:10 pm	**Milena Radnovic** Pseudo-integrable billiards and confocal conics

Exactly Solved Models and Beyond

Wednesday 22 July 2015

TIME	
9:00 am	**Ludwig Faddeev**: Some personal comments on the Algebraic Bethe Ansatz
9:45 am	**Jean-Michel Maillet**: From Yang-Baxter algebras to correlation functions of quantum integrable models: recent advances
Morning Tea: 10:30 — 11:00 am	
11:00 am	**Yu-Peng Wang**: On the inhomogeneous T-Q relation
11:45 am	**Vladimir Bazhanov**: Yang-Baxter equation: past, present and future
Lunch: 12:30 — 2:00 pm	
2:00 pm	**Alexey Litvinov**: Liouville reflection operator and integrable structure of conformal field theory
2:30 pm	**Alex Owczarek**: Exact solution of some friendly directed walker problems
3:00 pm	**Wen-Li Yang**: On the Bethe ansatz solution of the τ_2–model
Afternoon Tea: 3:30 – 4:00 pm	
4:00 pm	**Omar Foda**: From plane partitions to restricted solid-on-solid models
4:30 pm	**Michael Wheeler**: Macdonald polynomials from quantum integrability
5:00 pm	**James McGuire**: The Sommerfeld Ansatz: Solvable Diffraction

Exactly Solved Models and Beyond

Thursday 23 July 2015

TIME	
9:00 am	**Stanislav Smirnov**: Discrete complex analysis and 2D lattice models
9:45 am	**Nalini Joshi**: Symmetry through geometry
Morning Tea: 10:30 — 11:00 am	
11:00 am	**Atsuo Kuniba**: Multispecies TASEP and the tetrahedron equation
11:45 am	**Jacques Perk**: The Early History of the Integrable Chiral Potts Model and the Odd-Even Problem
Lunch: 12:30 — 2:00 pm	
Free Afternoon	

Exactly Solved Models and Beyond

Friday 24 July 2015

TIME	
9:00 am	**Barry McCoy**: Confessions of an Ising addict
9:45 am	**Alexander Bobenko**: Discrete conformal mappings and Riemann surfaces
Morning Tea: 10:30 — 11:00 am	
11:00 am	**Chaiho Rim**: Irregular conformal block
11:45 am	**Andreas Klüemper**: Non-linear integral equation approach to sl(2|1)
Lunch: 12:30 — 2:00 pm	
2:00 pm	**Jean-Marie Maillard**: Algebraic Statistical Mechanics: "Diagonalising" Integrable Models
2:30 pm	**Geoffrey Campbell**: 25 papers in 25 minutes
3:00 pm	**Xi-Wen Guan**: Additivity rule and Wilson ratio of 1D many-body systems
Afternoon Tea: 3:30 – 4:00 pm	
4:00 pm	**Helen Au-Yang**: CSOS Models & Chiral Potts Models: Degeneracy of the Eigenspace and Quantum Loop Algebra
4:30 pm	**Jorgen Rasmussen**: Constructive fun with doodles: from diagram algebras to exact solutions
5:00 pm	**Murray Batchelor**: Something more about the Rabi model

Titles and Abstracts*

Intriguing Questions from Rodney Baxter That Changed My Life

George Andrews

Pennsylvania State University, USA

This talk will start with a survey some of my early work with Rodney and describe how the methods that arose from extensions of the Hard Hexagon Model continue to be relevant to current problems in mathematics.

* * *

CSOS Models & Chiral Potts Models: Degeneracy of the Eigenspace and Quantum Loop Algebra

Helen Au-Yang

Oklahoma State University, USA

The monodromy matrices of the τ_2 model are known to satisfy a Yang–Baxter equation with the six-vertex **R**-matrix as the intertwiner. The **R**-matrix in the Yang–Baxter equation determines the commutation relations of the elements of the monodromy matrices. We show the reason why in the superintegrable case the eigenspace is degenerate, but not in the general case. We then show that the eigenspaces of special CSOS models descending from the chiral Potts model are also degenerate. The existence of an $L(\mathfrak{sl}_2)$ quantum loop algebra (or subalgebra) in these models is also proven. The highest weight polynomial (or the Drinfeld Polynomial) of the representation is obtained by using the functional relations of the product of two transfer matrices following the method of Baxter in the superintegrable case.

* * *

Structure Constants and Integrable Bootstrap in Planar $N = 4$ SYM Theory

Benjamin Basso

École Normale Supérieure – Paris

I will present an integrable bootstrap program for computing OPE structure constants in planar $N = 4$ Super-Yang-Mills theory.

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*Arranged alphabetically by speaker name

Something more about the Rabi model

Murray Batchelor

Centre for Modern Physics, Chongqing University, China and
The Australian National University

The Rabi model, first introduced in 1937, is as canonical as the Ising model. It describes the simplest interaction between light and matter, and thus has widespread applications in quantum physics. Despite its simplicity, the eigenspectrum of the fully quantized version of the Rabi model has only recently been obtained analytically. In this talk I'll discuss some ongoing further developments.

* * *

Some academic and personal reminiscences of Rodney James Baxter

Rodney Baxter

The Australian National University

I discuss my academic career, including some personal memories and a brief discussion of the ideas that led to the solution of the eight vertex model, and to later work on other two-dimensional models.

* * *

Yang-Baxter equation: past, present and future

Vladimir Bazhanov

The Australian National University

I will review the development of the theory of the Yang-Baxter equation over the past 30 years and outline some of its future directions. Among various topics I will make an emphasis on the following interrelated questions:

- connections to quantum groups
- generalizations to 3 dimensions
- hidden 3D structures in 2D integrable lattice models
- the non-difference property and its connection to classical discrete integrable equations.

This talk is based on joint works with Vladimir Mangazeev and Sergey Sergeev.

* * *

Discrete conformal mappings and Riemann surfaces

Alexander Bobenko

Technische Universität Berlin

The general idea of discrete differential geometry is to find and investigate discrete models that exhibit properties and structures characteristic of the corresponding smooth geometric objects. We focus on a discrete notion of conformal equivalence of polyhedral metrics. Two triangulated surfaces are considered discretely conformally equivalent if the edge lengths are related by scale factors associated with the vertices. This simple definition leads to a surprisingly rich theory. We establish a connection between conformal geometry for triangulated surfaces, the geometry of ideal hyperbolic polyhedra and discrete uniformization of Riemann surfaces. Construction of discrete conformal maps is based on a variational principle in terms of dilogarithm. Applications in computer graphics will be demonstrated. Fragments from a new movie "conform!" will be shown.

* * *

Application of the hidden fermionic structure to the CFT

Hermann Boos

University of Wuppertal, Germany

We discuss the scaling limit of the fermionic operators that were originally constructed for the lattice six vertex model. We relate these operators to the usual Virasoro generators modulo the integrals of motion. Also the OPE in the fermionic basis and the recursion relations for the conformal blocks discovered by Al. Zamolodchikov in eighties as well as some other aspects are discussed.

* * *

25 papers in 25 minutes

Geoffrey Campbell

The Australian National University

A quick overview of 25 papers that arose from the past year of posts in the LinkedIn Number Theory Group. Number Theory these days is very applicable, with results pertaining to Cryptography, Partitions, q-series, Lattice Sums in Chemistry, Quasicrystals, the list goes on. At present the group has nearly 8000 members and has explored discussions from elementary topics, through to university level and on to the famous open questions, as well as many original insights into new and classical topics related to say, Euler, Gauss, Ramanujan, Erdos, right up to latest math research news and prizes.

* * *

Form factor relocalisation

Patrick Dorey

Durham University, United Kingdom

This talk will describe recent work with Guy Siviour and Gabor Takacs on the form factors of the sinh-Gordon model in a certain ('roaming') limit introduced by Alyosha Zamolodchikov. In this limit the corresponding field theory exhibits multiple scaling behaviours. At the level of the form factor expansion of correlation functions this turns out to be due to a novel behaviour of the support of the integrands, which 'relocalise' onto a grid in rapidity space.

* * *

Some personal comments on the Algebraic Bethe Ansatz

Ludwig Faddeev

Steklov Institute, St. Petersburg

I recall some highlights in the history of the Algebraic Bethe Ansatz and underline the role of Baxter's papers in its development.

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From plane partitions to restricted solid-on-solid models

Omar Foda

University of Melbourne, Australia

I wish to outline how starting from plane partitions, with specific weights and boundary conditions, one can compute correlation functions in restricted solid-on-solid models. Interestingly, the result is expressed directly in 'fermionic form'.

* * *

Exactly solved models in physics

Angela Foerster

Federal University of Rio Grande do Sul, Brazil

We review some exactly solved models in physics in the areas of condensed matter and cold atoms. First we briefly discuss the supersymmetric t-J Hamiltonian, a relevant model in the context of high Tc superconductivity. A simple integrable spin ladder system is also presented and used to describe the physics of some strong coupling ladder compounds.

Then we consider the two-site Bose Hubbard Hamiltonian and show that although very simple, this model captures interesting physical behavior, such as tunneling and self-trapping.

Finally, the one-dimensional attractive Fermi gas with spin imbalance is examined and it is shown that the results for the strong coupling regime provide a description of the quantum phases which are applicable to experiments with cold fermionic atoms confined to one-dimensional tubes.

* * *

Exact results for random matrices

Peter Forrester

University of Melbourne, Australia

Some exact results relating to the eigenvalue distributions of Hermitian and non-Hermitian matrices obtained in my research in the past few years will be reviewed.

* * *

Additivity rule and Wilson ratio of 1D many-body systems

Xi-Wen Guan

Wuhan Institute of Physics and Mathematics, China; the Chinese Academy of Sciences and The Australian National University

In this talk we demonstrate that susceptibility, compressibility and specific heat of one-dimensional multicomponent interacting systems of fermions and bosons are sums of individual components displaying an illuminating analogue with either parallel or series resistors in a circuit. This additivity rule provides deep insights into the universal dimensionless Wilson ratio, e.g. the ratio of the susceptibility or the compressibility to the specific heat divided by the temperature. We fnd that such a conceptually simple ratio novelly captures the essence of a wide range of phenomena from the spin and charge separation to multicomponent Luttinger liquids and the breakdown of these liquids near a critical point. Using exactly solvable model we further demonstrate such characteristics in a 1D w-component Fermi gas. We show that the Wilson ratio remarkably exhibits a plateau of $w(w+1)/3$ for $w \gg 1$ in the repulsive regime. In contrast, it may display plateaux of integers $1, 2^2, \ldots, w^2$ for the Fermi gas with a strong attraction. The Wilson ratio provides a measurable parameter for experimentally determining the Luttinger liquids and probing quantum criticality of quantum gases.

* * *

Sorting with two stacks and quarter-plane loops

Tony Guttmann

University of Melbourne, Australia

Following Rodney Baxter's seminal solution of the 8-vertex model in the early '70s, there was much discussion about the fact that it displayed a continuously variable critical exponent, a result that at the time seemed to violate universality. While this feature is now understood, it is still an unusual characteristic of simple systems. However if one considers simple random walks in the plane that return to the origin (called *loops*), it has recently been shown by Albert and Bousquet-Mlou that loops *confined to the first quadrant* and given a weight a to their north-east and south-west corners, display continuously varying critical exponents as a function of a. This is not the case for half-plane or full-plane loops.

Seemingly independently, there are three classic problems in theoretical computer science, posed by Knuth in the 1960s. Knuth asked for the number of permutations of length n that could be sorted by (a) two stacks in parallel, (b) two stacks in series and (c) a double-ended queue, or deque. These have resisted attack until now. Recently Albert and Bousquet-Mlou solved the first problem by relating the generating function to that of quarter-plane loops. More recently still, in joint work with Andrew Elvey-Price we have done the same for deques, and established the (unusual) asymptotics (numerically) for both problems. For two stacks in series, we give numerical estimates of the asymptotics, but are unable to give a complete solution.

* * *

Quantum toroidal algebras and Bethe ansatz

Michio Jimbo

Rikkyo University, Japan

We establish the method of Bethe ansatz for the XXZ type model obtained from the R matrix associated to quantum toroidal $\mathfrak{gl}_1$ algebra. Our main tool is a functional realization of modules called shuffle algebra. The Hamiltonian of the model arises as appropriate projection of a multiplication operator by symmetric functions.

This is a joint work with B.Feigin, E.Mukhin and T.Miwa.

* * *

Symmetry through geometry

Nalini Joshi

University of Sydney, Australia

In this talk, we provide a new perspective on the search for symmetries of difference equations, by using a simple, beautiful geometric structure revealed in our recent study. The objects of this study are partial difference equations that arise as discrete versions of famous PDEs. These discrete systems consist of equations fitted together in a self-consistent way on a square, a 3-cube or an N-dimensional cube. By using the beautiful geometric structure of space-filling polytopes, we show how to find their unexpected symmetry reductions.

N. Joshi, N. Nakazono and Y. Shi (2014). "Geometric reductions of ABS equations on an n-cube to discrete Painlevé systems." Journal of Physics A-Mathematical and Theoretical 47: 505201 (16pp).

* * *

Quantum dilogarithm and exactly solved models of TQFT

Rinat Kashaev

University of Geneva, Switzerland

We review the role played by the quantum dilogarithm in exactly solved models of TQFT associated to Chern–Simons theory with non-compact gauge groups.

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New solutions of the star-triangle relation with discrete and continuous spin variables

Andrew Kels

The Australian National University

This talk will review some recent new developments regarding the star-triangle relation. Three new solutions to the star-triangle relation will be presented, which are for Ising type models of interacting spins with discrete and continuous components. These new solutions notably appear as dualities in supersymmetric gauge theories, and can be obtained from a new generalisation of the elliptic beta integral which allows for the appearance of integer variables.

* * *

Non-linear integral equation approach to $\mathbf{sl}(2|1)$

Andreas Klümper

The University of Wuppertal, Germany

An integrable sl(2|1) invariant network model with alternating 3 and $\bar{3}$ representations on vertical and horizontal lines is considered. This system can be formulated equivalently as a superspin chain. The model is 'solvable' by nested Bethe ansatz which yields two sets of coupled equations for the Bethe roots.

* * *

Multispecies TASEP and the tetrahedron equation

Atsuo Kuniba

University of Tokyo

I shall report on the hidden 3D structure revealed recently in the n-species totally asymmetric simple exclusion process (n-TASEP) on L site periodic chain which is a model of non-equilibrium stochastic dynamics in 1D. The well-known combinatorial algorithm for constructing the steady state by Ferrari-Martin is identified with a composition of combinatorial R for the quantum affine algebra $U_q(\widehat{sl}_L)$ in crystal base theory. Based on this finding and the factorized form of the R matrix derived recently from the tetrahedron equation, a new matrix product formula is obtained for the steady state probability. It is expressed in terms of size n corner transfer matrices of the q-oscillator valued five-vertex model at $q = 0$. They obey a quadratic algebra encoding the steady state condition, which turns out to be a far-reaching consequence of the tetrahedron equation and the commutativity of layer-to-layer transfer matrices. (Joint work with S. Maruyama and M. Okado)

* * *

Electron-hole asymmetry of the p+ip pairing model.

Jon Links

University of Queensland, Australia

The p+ip pairing model arises in studies of superconductivity. I will examine the electron-hole asymmetry of the model from the perspective of the Bethe Ansatz solution. A main result of the study is that for the attractive system there is a region in parameter space whereby all states occur as partial condensates of hole-pairs.

* * *

Liouville reflection operator and integrable structure of conformal field theory

Alexey Litvinov

Landau Institute of Physics and Technology, Chernogolovka, Russia and
Rutgers University, USA

As it becomes clear recently, the Liouville reflection operator plays an important role in the description of integrabily of two-dimensional conformal field theory. I review the latest results in this direction: Yang-Baxter algebra, construction of commuting Integrals of Motion, Bethe anzatz equations for the spectrum etc.

* * *

An integrable case of the $p + ip$ pairing Hamiltonian interacting with its environment

Inna Lukyanenko

The University of Queensland, Australia

We consider a generalisation of the $p+ip$ pairing Hamiltonian with external interaction terms. These terms allow for the exchange of particles between the system and its environment. As a result the $\mathfrak{u}(1)$ symmetry associated with conservation of particle number, present in the $p+ip$ Hamiltonian, is broken. Nonetheless the generalised model is integrable. We establish integrability using the Boundary Quantum Inverse Scattering Method, with one of the reflection matrices chosen to be non-diagonal. We also present the corresponding Bethe Ansatz Equations, the roots of which parametrise the exact solution for the energy spectrum.

* * *

Fidelities in the spin-boson model

Sergei Lukyanov

Rutgers University, USA

The spin-boson model (or the dissipative two-state system) is a model for the study of dissipation and decoherence in quantum mechanics. The spin-boson model with Ohmic dissipation is an integrable theory, related to several other integrable systems including the anisotropic Kondo and resonant level models. Here we consider the problem of computing the overlaps between two ground states corresponding to different values of parameters of the Ohmic spin-boson Hamiltonian. We argue that this can be understood as a part of the problem of quantizing the mKdV/sine-Gordon integrable hierarchy. The main objective of this talk is to analyze how the Anderson orthogonality affects the Yang-Baxter integrable structure underlying the theory.

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Algebraic Statistical Mechanics: "Diagonalising" Integrable Models

Jean-Marie Maillard

Centre Nationale de la Recherche Scientifique, France and
the University Pierre and Marie Curie, France

We recall that diagonals of rational functions naturally occur in lattice statistical mechanics and enumerative combinatorics. We first illustrate this natural appearance of diagonals of rational functions on the n-fold integrals of the (infinite) decomposition of the full susceptibility of the Ising model. In all the examples emerging from physics, the (minimal order) linear differential operators annihilating these diagonals of rational functions have been shown to actually possess orthogonal or symplectic differential Galois groups. In order to understand the emergence of such orthogonal or symplectic groups, three sets of diagonals of rational functions, corresponding respectively to rational functions of three variables, four variables and six variables are analysed exhaustively. We find that the (minimal order) linear differential operators annihilating the diagonals of these rational functions, which, at first sight, have no relation with physics, do have orthogonal or symplectic differential Galois groups. In general, diagonals of rational functions "almost systematically" (but not always !) yield linear differential operators with selected differential Galois groups. We finally show that, modulo integers that are powers of 2, the series expansion of full susceptibility of the Ising model is the same as the series expansion of the sum of the first n-fold integrals of the decomposition: the series expansion of full susceptibility is thus the same as diagonals of rational functions, and it thus identifies with algebraic functions modulo powers of 2.

* * *

From Yang-Baxter algebras to correlation functions of quantum integrable models: recent advances

Jean-Michel Maillet

École Normale Supérieure, France

We review our approach to the computation of correlation functions and of form factors in the finite volume in the framework of the quantum inverse scattering method, with the main example of the Heisenberg XXZ spin–1/2 chain in a magnetic field. In particular, we discuss the basic ingredients of the method, including the solution of the quantum inverse scattering problem and the determinant representations for scalar products of Bethe states, and some of the results obtained, like the formulas for form factors and correlation functions in the finite volume and in the thermodynamic limit. Finally, the critical large distance asymptotic behavior of general n–point functions of local operators is derived from these results together with an explicit link to conformal field theories that can be described here at the operator level.

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Confessions of an Ising addict

Barry McCoy

The State University of New York at Stony Brook, USA

No one can be said to understand a paper until they generalize it. I will use this opportunity to present the many curious things which I do not undestand about the Ising model in a magnetic field on a square lattice ranging from $H = 0$ to the hard square limit at $H = \infty$. The goal is to present a scenario for the analyticity of the free energy which incorporates the natural boundary found by Nickel in the susceptibility.

* * *

The Sommerfeld Ansatz: Solvable Diffraction

James McGuire

Florida Atlantic University, USA

Diffraction is a generic phenomenon of wave mechanics. Typically boundary conditions and coordinate interactions lead to an infnite superposition of plane waves, i.e. diffraction, where the solution is an integral representation. The Sommerfeld Ansatz is a set of assumptions that enable construction of this integral representation. In special circumstances the integrals of this integral representation are "doable" by algebraic methods. The Sommerfeld Ansatz provides precise insight into the nature of these special circumstances.

* * *

From the exact characterization of the spectrum of quantum integrable models towards their exact dynamics by separation of variables

Giuliano Niccoli

École Normale Supérieure, France

I will describe the method of quantum separation of variables (SOV), first introduced by Sklyanin, for the analysis of the spectrum of integrable quantum model. SOV can be applied to a large class of integrable quantum models, which are not analyzable by other methods, and it has as a fundamental built-in feature the completeness of spectrum description. I will describe how to implement it for general integrable quantum models associated to both Yang-Baxter and Reflections algebras of 6-vetex type. I will also mention the further generalization required and achieved by us for the SOV description of the integrable quantum models of 8-vertex type.

Then, I will focus on the characterization of the quantum dynamics in the SOV framework. Here, our first main finding is the universality of the representation of scalar products and matrix elements of local operators by determinant formulae. Our second main finding is the proof that these formulae admit rewriting similar to those appearing in the context of algebraic Bethe ansatz, like Izergins and Slavnovs determinants. These representations are of particular interest as they provide the natural framework to implement the analysis of their homogeneous and thermodynamic limits.

Finally, I will complete the seminar with some current projects concerning applications of the SOV method which go from the spectral analysis of others integrable quantum models to the computation of their correlation functions.

* * *

Exact solution of some friendly directed walker problems

Alex Owczarek

University of Melbourne, Australia

We consider three different lattice models involving directed random walks on the square lattice that can share edges of the lattice but do not cross, known as friendly walkers. Importantly, these models have multiple interaction parameters. We explain how we can find the exact solution of these models using the so-called "kernel method", and discuss the types of solution and the asymptotic behaviour of the walks as models of polymer adsorption, DNA denaturation, and gelation.

* * *

Fused RSOS models as higher-level nonunitary minimal models

Paul Pearce

University of Melbourne, Australia

We consider the RSOS of Forrester-Baxter models with crossing parameter $\lambda = (m'-m)\pi/m'$ in Regime III. In the continuum scaling limit, these models are described by the minimal models $\mathcal{M}(m,m')$. We conjecture that, for $\lambda < \pi/n$, the $n \times n$ fused RSOS models are described by the higher-level coset $(A_1^{(1)})_k \otimes (A_1^{(1)})_n/(A_1^{(1)})_{k+n}$ at fractional level $k = nM/(M'-M) - 2$ with $(M,M') = (nm-(n-1)m', m')$. Using one-dimensional sums arising from Baxter's Corner Transfer Matrices, we identify the groundstate RSOS paths and relate them to the (r,s,ℓ) quantum numbers. For $n = 2, 3$, we have obtained the local energy functions $H(\sigma_{j-1}, \sigma_j, \sigma_{j+1})$ and verified in Mathematica that the one-dimensional sums produce the expected finitized fermionic branching functions. This work is joint with Elena Tartaglia.

* * *

The Early History of the Integrable Chiral Potts Model and the Odd-Even Problem

Jacques Perk

Oklahoma State University, USA

In the first part of the talk I shall discuss the round-about way of how the integrable chiral Potts model was discovered about 30 years ago. As there should be more higher-genus models to be discovered, this might be of interest. In the second part I shall discuss some quantum group aspects, especially issues of odd versus even N related to the Serre relations conjecture in our quantum loop subalgebra paper of 5 years ago and how we can make good use of coproducts, also borrowing ideas of Jimbo, Deguchi, Fabricius, McCoy and Nishino.

* * *

Pseudo-integrable billiards and confocal conics

Milena Radnovic

The University of Sydney, Australia

We consider a new class of billiard systems with boundaries formed by finitely many arcs of confocal conics such that they contain some reflex angles and derive their fundamental dynamical, topological, geometric, and arithmetic properties.

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Constructive fun with doodles: from diagram algebras to exact solutions

Jorgen Rasmussen

University of Queensland, Australia

An informal introduction to loop models is presented. These models have become fundamental tools in the description of physical systems with nonlocal degrees of freedom such as polymers and percolation. Their basic degrees of freedom are encoded in connectivities and are thus topological in nature. As intimidating as this may sound, underlying diagram algebras offer unlimited doodling fun for the whole family and can be used to establish integrability of the associated physical models. Critical dense polymers, in particular, can subsequently be solved exactly in a way rivalled only by the Ising model.

* * *

Irregular conformal block

Chaiho Rim

Sogang University, South Korea

Irregular conformal block is introduced and evaluated using a random matrix model. The role of the conformal symmetry such as the visrasoro and W symmetry will be clarified.

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Discrete complex analysis and 2D lattice models

Stanislav Smirnov

University of Geneva, Switzerland and St. Petersburg State University

We will give an overview of the recent results on the planar lattice models, obtained using discrete complex analysis and Schramm's SLE. Then we will discuss our joint work with D. Chelkak and A. Glazman on $O(n)$ models and discrete versions of the stress energy tensor.

* * *

Correlation functions of the Heisenberg-Ising chain

Junji Suzuki

Shizuoka, Japan

I will report on the recent progress on the quantitative analysis of the correlation functions of the spin 1/2 XXZ model at zero and at finite temperatures. The talk is based on the collaboration with M. Dugave, F Goehmann (Wuppertal) and K. Kozlowski (Bourgorne).

* * *

A Bethe Ansatz Approach to ASEP

Craig Tracy

University of California, Davis, USA

In the one-dimensional, asymmetric simple exclusion process (ASEP), particles are at integer sites on the line. Each particle waits exponential time, and then:

1. with probability p it moves one step to the right if the site is occupied, otherwise it does not move;
2. with probability $q = 1 - p$ it moves one step to the left if the site in unoccupied, otherwise it does not move.

For the special case of *step initial conditions*, we explain how ideas from Bethe Ansatz, coupled with some combinatorial identities and functional analysis, lead to an exact formula for $\mathbb{P}(x_m(t) \leq x)$, the probability that the m^{th} particle's location is less than or equal to x at time t. This work, done in the period 2007–08, is joint work with Harold Widom. An overview of this work can be found in arXiv:1101.2682.

* * *

On the inhomogeneous T-Q relation

Yu-Peng Wang

Chinese Academy of Sciences, Beijing

Solving the quantum integrable models without an obvious reference state (lack of U(1) symmetry) had been a longstanding problem. In this talk, I will give some description about the off-diagonal Bethe Ansatz (ODBA) method, especially the construction of the inhomogeneous T-Q relations for generic integrable models either with or without an obvious reference state. With the open XXX spin chain as an example, I will also show the completeness of solutions via ODBA and the method to retrieve the Bethe eigenvectors based on the inhomogeneous T-Q relation.

* * *

An identity in search of a Baxter

Ole Warnaar

The University of Queensland, Australia

In 1980 Rodney Baxter famously rediscovered the Rogers–Ramanujan identities in his solution of the hard-hexagon model. In this talk I will explain that from the point of view of representation theory the Rogers–Ramanujan q-series correspond to characters of irreducible highest-weight modules of the affine Lie algebra $\mathrm{A}_2^{(2)}$. I will then show how to generalise the Rogers–Ramanujan identities by considering the more general Lie algebra $\mathrm{A}_{2n}^{(2)}$.

* * *

Macdonald polynomials from quantum integrability

Michael Wheeler

The University of Melbounre, Australia

We present two new formulas for Macdonald polynomials. Our construction is based on many central themes in quantum integrability, including polynomial solutions of the qKZ equation, the Faddeev–Zamolodchikov algebra, and t-oscillator solutions of the Yang–Baxter algebra.

This is joint work with Luigi Cantini and Jan de Gier.

* * *

To Be Announced

Masahito Yamazaki

University of Tokyo, Japan

* * *

On the Bethe ansatz solution of the τ_2–model

Wen-Li Yang

Northwestern University, USA

Bethe ansatz solutions of the most general cyclic representations of the quantum τ_2–model (also known as Baxter-Bazhanov Stroganov (BBS) model) with periodic boundary condition has been studied. The eigenvalues of the corresponding transfer matrix are given in terms of an inhomogeneous $T-Q$ relation for a generic case. The associated Bethe ansatz equations are obtained.

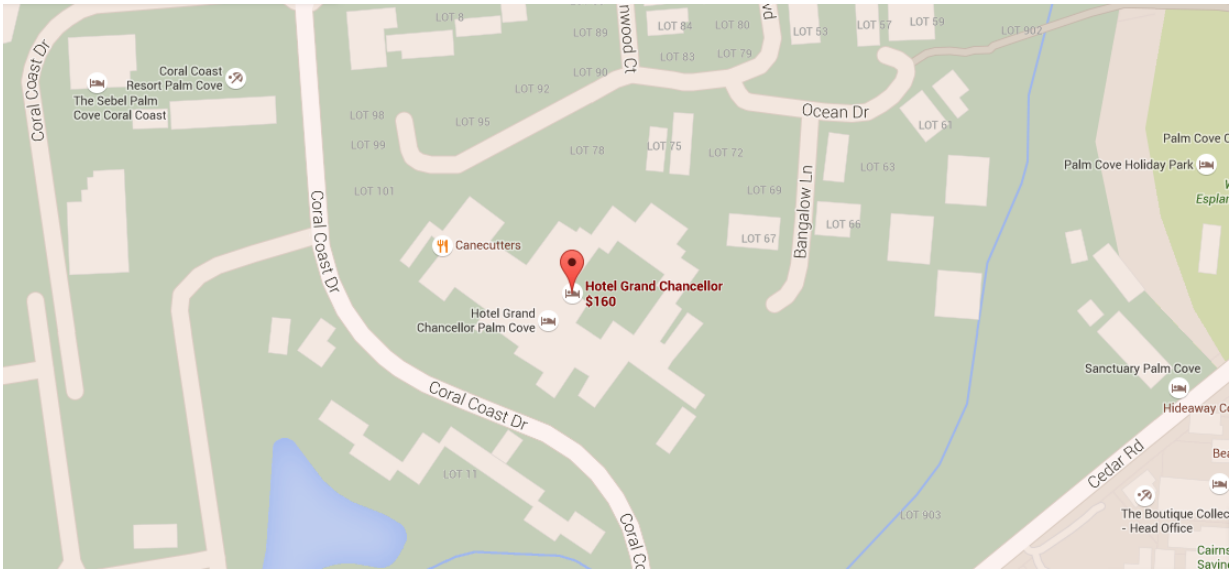
* * *

Miscellaneous Information

Hotel

The hotel you will be staying at is called the "Hotel Grand Chancellor". It is a four star hotel around 20 minutes from the airport and a very short walk to the beach. We hope you enjoy your stay there.

- Address: **Coral Coast Drive, Palm Cove, Queensland, 4879**
- Phone Number: **+61 (7) 4059 1234**
- Website: `http://www.grandchancellorhotels.com/au/palmcove/`



Registration, Reception and Events

Registration

- Venue: The Hotel Grand Chancellor
- Date: Sunday the 19th of July
- Time: 14:00 to 17:00

Reception

- Venue: The Hotel Grand Chancellor
- Date: Sunday the 19th of July
- Time: 18:00 to 20:00

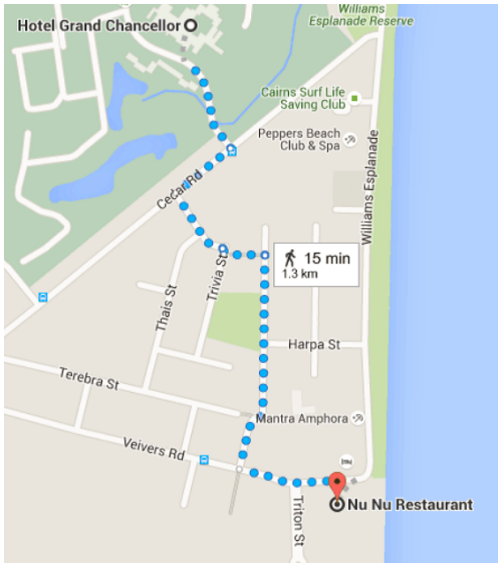
Conference Dinner and Venue, General information

Conference Dinner

- Venue: The Nu-Nu Restaurant
- Date: Wednesday, the 22nd of July
- Time: 19:00 to 22:00

The Nu-Nu restaurant is by the beach, around a 15 minute walk from the hotel.
It is located at:

- **1 Veivers Road, Palm Cove, Queensland**.



General Conference Information

Conference Venue

- Lectures will be held at the Conference Centre of the Hotel. Please ask Hotel staff for directions if you have trouble finding it.

Food

- Breakfast and Lunch will be served at the Hotel restaurant.
- Morning Tea and Afternoon Tea will be provided at the Conference venue.

Internet

- There is free wireless internet at the hotel. Please ask the hotel staff for details or assisstance.

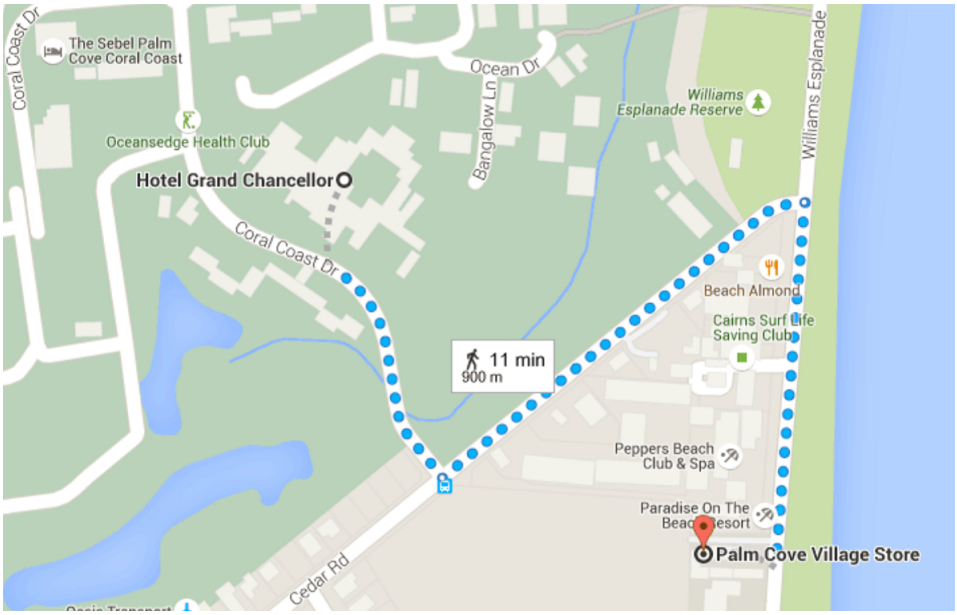
Stores – Convenience and Liquor

Stores

There are a number of grocery, convenience and liquor stores around Palm Cove and in the neighbouring suburb of Clifton Beach.

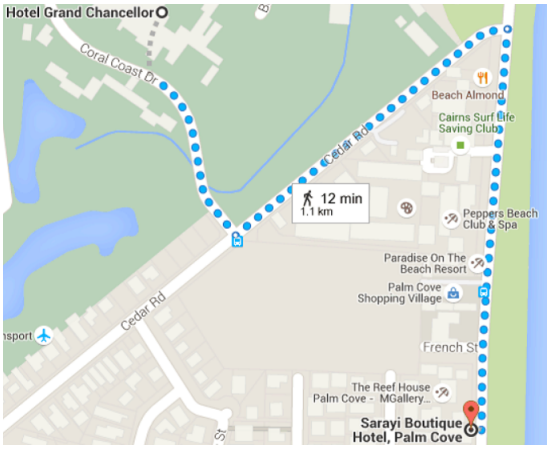
Palm Cove Village Store

Located on Williams Esplanade around a 10 minute walk from the hotel.



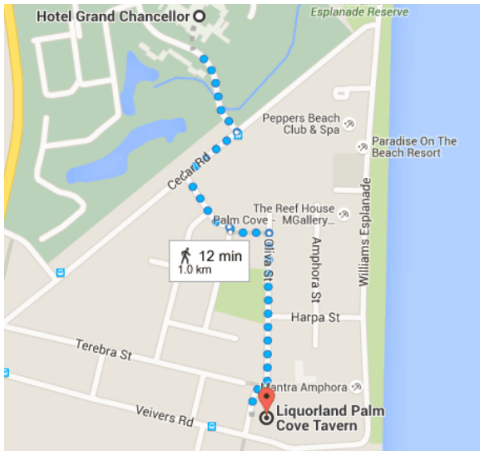
The Pantry Supermarket

Located further down on Williams Esplanade, near the hotel "Sarayi".



Liquorland Palm Cove Tavern

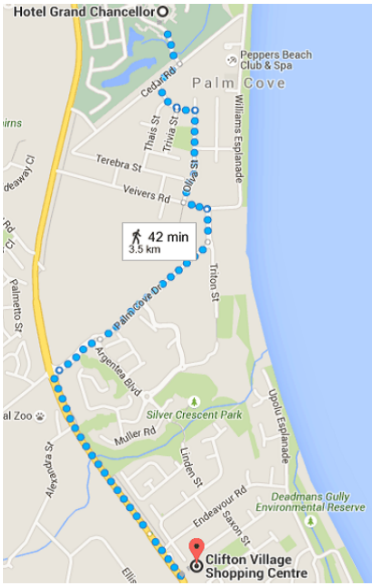
Around 15 minutes from the hotel and right next to the Nu-Nu Restaurant.

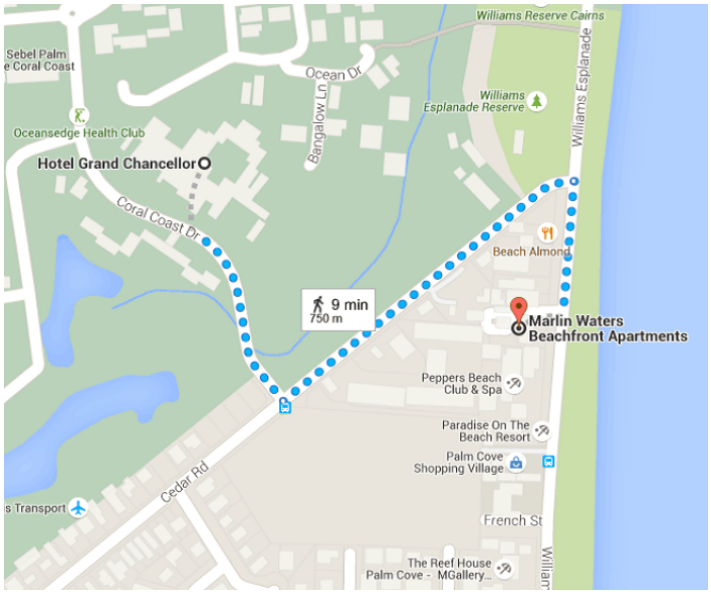


Stores – Shopping Centre, Swimming

Clifton Village Shopping Centre

The shopping centre is located around 3.5 km south of the Hotel Grand Chancellor.





Swimming

Swimming is particularly popular at Palm Cove and the beach that runs adjacent to Williams Esplanade is world–class. It is recommended, however, to swim only in areas patrolled by surf lifesavers. These are clearly marked by the yellow and red surf lifesaving flags; hence the Australian saying: "Swim between the Flags". The nearest patrolled beach to the hotel is located opposite the Marlin Waters Beachfront Apartments (see the above–right map).

Transport – Taxis, Shuttle Bus

Transport

Cairns International Airport is split into two main terminals. Terminal T1 handles all international flights while Terminal T2 handles all domestic flights. There are a number of options available for commuting between Palm Cove and Cairns Airport including taxis, shuttle buses and public transport.

Cairns Taxis (Simplest)

The City of Cairns operates the Cairns Taxis black and white taxi service. Both international and domestic terminals have a sheltered rank at the front of the building with taxis always available.

Taxis can be booked in advance but this is not necessarily a requirement. Sedans seat up to 4 people while 'Maxi-Taxi' services can seat up to 10.

Fare prices for taxis depend on the time of the day. The cheapest rates are between the hours of 7am and 7pm. For this time period, estimates on price between the airport and the hotel are $67 for a sedan taxi and $104 for a maxi-taxi. Fares are typically $5 extra for services outside these hours. Also expect a toll of $4 to be added to the fare price for journeys to and from the airport.

For more information, one can visit the website `http://www.cairnstaxis.com.au` or call them directly on **(+61) 7 4048 8308**.

Shuttle Bus

Shuttle buses are operated by companies Exemplar Coaches and Sun Palm. Services from the airport to the hotel typically do not follow a fixed schedule while services from the hotel to the airport do. Booking your trip back to the airport is highly recommended.

Exemplar Coaches

From the airport to the hotel (*Seat-in-coach service*):

- Single travellers can book a seat on a coach which is shared by many.
- Cost is $22 for an adult.
- Departure times vary – the shuttle leaves once all customers have boarded.
- No service desk, you will need to phone **+61 7 4098 5473** or go online: `http://exemplaronline.com.au` to reserve your seat.
- If booking online, remember that the drop off point is Hotel Grand Chancellor, Palm Cove, and the cost is $22. You will need to input the cost manually into the appropriate section.

Ph: +61 7 4098 5473

Transport – Coaches, Public Transport

From the hotel to the airport:

- Coach sevices from the hotel to the airport run on a fixed timetable.
- See `http://www.exemplaronline.com.au/TheJourney/tabid/59/Default.aspx` for more details or ask the Hotel staff.

Palm Sun Coaches

- Palm Sun coaches have a desk at the international and domestic terminals.
- Price from airport to Palm Cove is $18 per person.
- Shuttles depart at 5:30, 7:30, 9:30, 10:30, 11:30, 13:00, 14:30, 16:30, 18:30, 22:00 and midnight, direction: Northern Beaches and Port Douglas.
- More information, including timetable can be found at: `http://sunpalmtransport.com.au/daily-schedules/`

Ph: +61 7 4099 1191

Public Transport Bus (Most Complex)

The bus network provided by the City of Cairns is known as **Sunbus**. The network has no bus stop within the airports perimeter, however Sun Palm offer a free connecting shuttle service to and from the closest bus stop located on Sheridan Street. Information on the Sun Palm shuttle can be found by following:
`http://www.cairnsairport.com.au/airport-connect-shuttle/`

Arrival

On arrival, you will need to go to the Sun Palm welcome desk located in the arrivals terminals of the airport to use this service. Services leave from the airport every 30 minutes. You will dropped off on the **Southbound** side of Sheridan street. Buses from this stop will head towards the city centre. To get to the hotel you will need to cross the road to the **Northbound** bus stop and take Route 110 (110N at night) to the Cedar Street cnr. Coral Coast Drive bus stop at Palm Cove.

Ph: +61 7 4057 7411

Please Note: The timetable for weekdays and weekends are different and buses do not operate at all hours.

The timetable for all routes through this bus stop are given at:

`http://www.cairnsairport.com.au/wp-content/uploads/2015/03/CairnsSept2014StopPoster750105750142March2015.pdf`

The Hotel Grand Chancellor is on the right hand side a short walk up Coral Coast Drive from the bus stop.

Public Transport – Departure

Departure

Departing the hotel requires you to take the same southbound bus stop on Cedar St cnr. Coral Coast Drive. Route 110 (110N at night) will take you to the corner of Sheridan St and Arthur St (near Tobruk Pool). There you will need to cross the road to the Northbound bus stop and wait for the Sun Palm shuttle which passes by at quarter past every hour from 4:15am – 10:15pm.