

**Workshop on Integrable Systems and Orthogonal  
Polynomials 2018**

**2018 可积系统与正交多项式研讨会**

**January 12 – 14, 2018**

**2018 年 1 月 12–14 日**

**School of Mathematical Sciences**

**Fudan University, Shanghai**

**上海复旦大学数学科学学院**

# 会议日程

1月12日	注册
1月13日	
地点： 光华楼东主楼 2001 室	
8:30–8:50	注册
8:50–9:00	开幕式
主席：范恩贵	
9:00 – 9:40	胡星标 <i>正交多项式与可积系统的若干研究</i>
9:40 – 10:20	王东 <i>圆环上 Asymmetric Simple Exclusion Process 的转移概率函数和边缘分布</i>
10:20 – 10:50	茶歇
主席：胡星标	
10:50 – 11:30	刘思齐 <i>TBA</i>
11:30 – 12:10	虞国富 <i>Riemann-Hilbert approach and N-soliton solution for a coupled modified nonlinear schrödinger equations</i>
午餐	
主席：刘思齐	
14:30 – 15:10	赵育求 <i>Connection problems for equations of the Heun class</i>
15:10 – 15:50	王可 <i>Recent results on the eigenvectors of random symmetric matrices</i>
15:50 – 16:20	茶歇
主席：虞国富	
16:20 – 17:00	常向科 <i>On peakon, Toda lattices and partition functions of random matrix ensembles</i>
17:00 – 17:40	邱彦奇 <i>Conditional measures of generalized Ginibre processes</i>
晚餐	

# 会议日程

<b>1月14日</b>	
地点： 光华楼东主楼 2001 室	
主席： 赵育求	
9:00 – 9:40	Tuen Wai Ng <i>Applications of Nevanlinna theory to the finding of all exact meromorphic solutions of nonlinear autonomous ODEs</i>
9:40 – 10:20	刘党政 <i>On the product of GUE and LUE</i>
10:20 – 10:50	茶歇
主席： 张仑	
10:50 – 11:30	徐帅侠 <i>Gap probability distributions of critical unitary random matrix ensembles</i>
11:30 – 12:10	董凤凤 <i>Inverse Spectral Problem and Peakons of an Integrable Two-component Camassa-Holm System</i>
午餐	
下午	自由讨论
17:30	晚餐
<b>1月15日</b>	离会

# 参会人员名单

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## 报告题目与摘要

### On peakon, Toda lattices and partition functions of random matrix ensembles

常向科

中国科学院数学与系统科学研究院

**摘要:** A class of nonlinear integrable PDEs admit some special weak solutions called “peakons”, which are characterised by ODE systems, namely peakon lattices. The celebrated Toda lattice was originally obtained as a simple model for describing a chain of particles with nearest neighbor exponential interaction. For some initial value problems, these lattices can be explicitly solved by use of inverse spectral method. The solutions are intimately related to partition functions of random matrix ensembles. In this talk, I will introduce our recent results on these related topics. The talk is based on several joint works with Xingbiao Hu, Shihao Li, Jacek Szmigielski et al..

### Inverse Spectral Problem and Peakons of an Integrable Two-component Camassa-Holm System

董凤凤

同济大学

**摘要:** In this paper, we are concerned with the explicit construction of peakon solutions of the integrable two-component system with cubic non-linearity, which was proposed by Xia and Qiao. We establish the spectral and inverse spectral problem associated to the Lax pairs of the system. The inverse problem is solved by the classical results of Stieltjes continued fractions, which also contributes a lot to the spectral problem. The explicit formulas are

obtained from solutions of the inverse problem. The positivity of the spectral measures is implied by J. Moser's work on the Jacobi spectral problem.

### 正交多项式与可积系统的若干研究

胡星标

中国科学院数学与系统科学研究院

**摘要:** In the talk, I will report some new results on the connection between orthogonal polynomials and integrable systems. This is joint work with Xi-angke Chang, Xiaomin Chen Yi He and Shihao Li.

### On the product of GUE and LUE

刘党政

中国科学技术大学

**摘要:** We investigate spectral properties of the product of GUE and LUE random matrices, and find an explicit expression of the joint probability density function as a bi-orthogonal ensemble. By providing explicit expressions both for the bi-orthogonal functions and the correlation kernel, a new double-side kernel is found at the origin, which is slightly different from the Bessel kernel.

### Applications of Nevanlinna theory to the finding of all exact meromorphic solutions of nonlinear autonomous ODEs

Tuen Wai Ng

香港大学

**摘要:** In this talk, we will explain how to apply Nevanlinna theory and local singularity analysis to find all exact meromorphic solutions of some nonlinear

autonomous ODEs, e.g., the ODEs coming from the traveling wave reduction of the one-dimensional quintic complex Ginzburg-Landau equation (CGL5).

## Conditional measures of generalized Ginibre processes

邱彦奇

中国科学院数学与系统科学研究院

**摘要:** I will talk about the conditional measures of generalized Ginibre point processes. We show that these conditional measures with respect to the configuration in the complement of a bounded domain in the complex plane, are orthogonal polynomial ensembles with weights found explicitly. This result, even in the classical Ginibre point process, is new. The talk is based on a joint work with Alexander Bufetov.

## 圆环上 Asymmetric Simple Exclusion Process 的转移概率函数和边缘分布

王东

新加坡国立大学

**摘要:** 一般的相互作用粒子模型很难通过具体的转移概率函数来求解。但是某些特殊的一维粒子模型可以通过 Bethe ansatz 写出转移概率函数的精确表达式, 并且通过这个精确表达式, 可以计算特定粒子的边缘分布, 以及求出它在粒子数趋近于无穷时的极限。这个方法在当前关于 Kardar-Parisi-Zhang (KPZ) universality class 的研究中有重要应用。本报告讨论一维 Asymmetric Simple Exclusion Process (ASEP) 在周期边界条件, 也就是定义在  $\mathbb{Z}/n\mathbb{Z}$  上的情况。我们得到了粒子系统的转移概率, 并且在任意初值条件下, 得到了任意一个粒子的分布函数。这个报告是基于和刘志鹏与 Axel Saenz 的近期合作结果。



## Recent results on the eigenvectors of random symmetric matrices

王可  
香港科技大学

**摘要:** Eigenvectors of large matrices and graphs play an essential role in combinatorics and theoretical computer science. For instance, many properties of a graph can be deduced or estimated from its eigenvectors. It is conjectured that an eigenvector of a random symmetric matrix behaves like a random vector uniformly distributed on the unit sphere. I will talk about some recent partial results toward confirming this conjecture.

## Gap probability distributions of critical unitary random matrix ensembles

徐帅侠  
中山大学

**摘要:** We study Fredholm determinants of the Painleve II and Painleve XXXIV kernels. The determinants describe the gap probability of eigenvalues in certain critical unitary random matrix ensembles. We obtain Tracy-Widom formulas for the determinants, which are explicitly given in terms of solutions to the coupled Painleve II system. Furthermore, the large gap asymptotics for these determinants are derived, where the constant factors are evaluated by the Riemann zeta-function.

## Riemann-Hilbert approach and N-soliton solution for a coupled modified nonlinear schrödinger equations

虞国富  
上海交通大学

**摘要:** We consider a coupled modified nonlinear schrödinger (CMNLS) equation that includes coupled NLS and modified NLS equation. In the framework of the Riemann-Hilbert method, we construct the compact N-soliton formula expressed by determinants. It's shown that starting from two different approaches to transform the irregular Riemann-Hilbert problem (RHP) into the regular RHP problem, we obtain the same soliton solutions. Based on the determinant solution, some properties for single soliton and asymptotic analysis of N-soliton solution are explored. The simple elastic interaction of N solitons is confirmed.

### **Connection problems for equations of the Heun class**

赵育求  
中山大学

**摘要:** We discuss the connections between the fundamental solutions at different singular points, taking as examples several equations of Heun class. The main tools used are the asymptotic theory of difference equations and the Riemann-Hilbert approach.