Yang Chen

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EDUCATION

- **Ph. D. (Physics)** University of Massachusetts 1987
- **M. Sc. (Physics)** Illinois Institute of Technology 1983
- **B. Sc. (Physics)** National University of Singapore 1981

RESEARCH INTERESTS

- Random matrix theory
- Multivariate Statistics
- Orthogonal polynomials and special functions
- Painleve Transcendents and Integrable Systems
- Random Matrices Applied to Wireless Communications

HONOR & AWARDS

- Macau Science and Technology Natural Science Award Third Prize, 2018
- Chang Jiang Scholarship awarded by the Ministry of Education of China, 2006
- Honorary Fellow, Department of Mathematics, University of Wisconsin-Madison (Invited by Professor Richard Askey) 2002

ACADEMIC APPOINTMENT

Professor: Department of Mathematics, University of Macau 2012-present

Professor(Personal Chair): Department of Mathematics, Imperial College London 2004-2012

Reader: Department of Mathematics, Imperial College London 1997-2004

Lecturer: Department of Mathematics, Imperial College London 1992-1997

Visiting Scholar: Stanford University (Invited by Professor Iain Johnstone) 2009

Postdoctor Fellow: Max-Planck-Institut für Festkörperforschung (with professor Konstantin Efetov) 01/1991–02/1992

Postdoctor Fellow: Institut für Theorie der Kondensierten Materie University (with Professor Peter Wölfle) 10/1989–01/1990

Visiting Scientist: University of Florida-Gainesville 11/1988–02/1989

Postdoctor Fellow: Cavendish Laboratory (with Professor Sam Edwards) 1986–1988

Research Assistant: University of Massachusetts-Amherst 1983-1986

Research Assistant: Illinois Institute of Technology 1981-1983

PROFESSIONAL ACTIVITIES

▷ **Professional referee for mathematics journals**:

• Inventiones Mathematicae
• The Ramanujan Journal
• Journal of Approximation Theory
• Indagationes Mathematicae
• Journal of Computational and Applied Mathematics
• Constructive Approximation

▷ **Professional referee for physics journals**:
• Physical Review Letters
• Physical Review B
• Physical Review E
• Journal of Physics A: Mathematical and Theoretical
• Journal of Physics C: Condensed Matter
• Physics Letter A

▷ **Professional External referee for**
• Promotion Committees, from Associate to Full Professor:
(1) University of California-Santa Cruz;
(2) University of Arizona-Tucson
• Senior Research Fellowship Committee of Engineering and Physical Science Research Council, UK
• Advanced Fellowship Committee of Engineering and Physical Science Research Council, UK
• Referee for research grant applications for the Engineering and Physical Science Research Council
• The Nuffield Foundation's Scholarship Committee
• For the President of the London Mathematical Society's Junior Whitehead Prize Committee

Appraisal on Freeman Dyson as requested by the President of the London Mathematical Society (LMS) on Dyson's election as Honorary Fellow of the LMS.

• Founding Editor and Co-Editor-in-Chief, **Random Matrices: Theory and applications. Publisher World Scientific**

PhD Students (University of Macau)

1. Zhang Yashan (Graduated, August 2017). Now Associate Professor, Hunan University.
2. Ao Jian Yu (Graduated, August 2018). Now Post-Doc, Shanghai Mathematics Research Institute.
3. Min Chao (Graduated, May 2016). Now Assistant Professor, Hua Qiao Univeristy.
4. Lyu Shulin (Graduated, July 2017). Now Research Fellow, ZhongShan University (Zhu Hai Campus).
5. Chen Min (Graduated, May 2016). Now Post-Doc, Holon Institute, Israel.
6. Zhu Mengkun (Graduated, 2018). Now Assistant Professor of Mathematics, Qi Lu University of Technogy (Shandong Science and Technology Institute)
7. Chen Hong Mei, (Graduated, November 2018). Now Lecturer, Beijing Institute of Graphic Communications. Co-Supervisor, Galina Filipuk, Assistant Professor, Faculty of Mathematics, Informatics and Mechanics, Univeristy of Warsaw.
8. Han Pengju (Graduated, September 2018). Now assistant Professor of Mathematics, Wuhan agriculture university.
9. Zhan Longjun (Graduted, March 2019). Now Post Doc, Fudan University.

Ongoing PhD students
1. Hu Jie, (Current PhD student, August 2018, expected to defend thesis in 2021). Co-Supervisor, Galina Filipuk.
2. Wang Dan, (Current PhD student, August 2018, expected to defend thesis in 2021).Co-Supervisor, Galina Filipuk.

PhD students(UK)
Five PhD students from Imperial College London, when I worked in the Mathematics Department of Imperial College. One from the Cavendish Laboratory, Cambridge University.

Referees
Although the referees listed below are not formally Physicists, they maybe considered to be mathematical physicists, since the problems they work in are drawn from Statistical Mechanics, tiling problems, stochastic processes, and partial differential equations.

• Ari Laptev, Professor of Mathematics,
Imperial College London, follow this link http://wwwf.imperial.ac.uk/ alaptev/
a.laptev@imperial.ac.uk
+44 (0)20 759 48499 (office)

• Estelle Basor,
Deputy Director, American Institute of Mathematics,
Paolo Alto, California, USA
ebasor@aimath.org

•Peter Forrester,
Laureate Professor
University of Melbourne
pjforr@unimelb.edu.au

PUBLICATIONS

▷ **Google Scholar and ResearchGate Profile via the following links:**

• https : //www.researchgate.net/profile/Yang − Chen19

• https : //scholar.google.com/citations?hl = en&user = q − LZZbwAAAAJ

• ORCID.ORG/0000 − 0003 − 2762 − 7543

https://www.fst.um.edu.mo/people/yayangchen/

RESEARCH AND EDUCATION

My research and education activities are intimately intertwined. Normally, I will work on a problem that I find interesting and would bring a student along the research journey, usually focusing on problems related to Random Matrices—a hot topic in Mathematical Physics. We work intensively over a period of time, ultimately the results are either published or accepted for publications.

My sense is that the current Universities' policy world wide is at least one accepted or published paper are required before graduation. This was more or less the situation at Imperial College and the same at the University of Macau.

I spend half a year at the Nankai University, Tianjin China (2005–2006), as a Visiting Professor at Mathematics Department–Center of Combinatorics, and a semester at the Fudan University's Mathematics Department, (2007–2008).
Almost all my former PhD students are currently academics in Universities in Mainland

China. Through these connections, I hope to work with the admission office of your School to recruit International students, and good students from all over the world.
I also work with colleagues (Gordon Blower (Lancaster, UK), Estelle Basor (AIM USA), En Gui Fan (Fudan, Shanghai)) on problem related to random matrices, mainly on ensembles with Hermitian symmetry (the $\beta = 2$ problems). It turns out that Hermitian cases are intimately related the determinant of Hankel (or moment) matrices. This 19th century mathematical object of great interest because of their appearance in approximation theory, spherical functions, differential equations, see "Hanbuch der Kugelfunctionen. Theorie and Anwendungen," E. Heine, Berlin Druck und Verlag von G. Reimer, 1878, for an exposition on this and related topics. The "grand father" of Special function texts.

My work on Hermitian ensembles is mainly concerned with the "perturbation" of classical ensembles generated by Normal e^{-x^2}, $x \in \mathbf{R}$, Gamma $x^\alpha \mathrm{e}^{-x}$, $x > 0, \alpha > -1$, and Beta densities $x^\alpha (1-x)^\beta$, $\alpha > -1$, $\beta > -1, 0 < x < 1$.

By perturbation, I mean the multiplication of the "classical densities" by "time" dependent factors. Such factors are usually motivated by the problem at hand; here are some examples,
1. The factor $(1 + x/t)^\lambda$ for the moment generating function of Shannon entropy—a fundamental characterization of the information entropy of the wireless communication systems,
2. The factor $\mathrm{e}^{-t\,x}$ for the moment generating function of the centre of mass of the point particle (or eigenvalues) that constitute the ensemble,
3. The factor $\mathrm{e}^{-t/x}$ for the moment generating function of the Wigner delay time distribution,
4. The factor $\theta(x - a)$ for the probability that a gap $[0, a]$ is formed.

In all of these , the t or a dependent of $N \times N$ Hankel determinants can be described by a number of Painleve equations, where the parameters depend of N. Ultimately, the infinite N behaviour of the Hankel determinant is of great interest, in this situation, the "larger" Painleve reduces to "smaller" Painleve, without the appearance N, obtained under suitable double scaling, typically a combination N and t, a kind of thermodynamic limit. I will continue to pursue this research direction, suitable for students thesis.

Management
I have spent almost 30 years, 1992 to 2021, working in Academic Institutions. At Imperial College London from 1992 to 2012, as Lecturer, Reader and Professor (Personal Chair) of Mathematical Physics. I was invited by a Senior Mathematician (currently retired) to join the University of Macau as Professor of Mathematics (with Tenure), this is what I did in August 2012.
My management activities mainly stem from supervision of students; Undergraduate, Masters and PhDs.
In addition, I work with contemporary mathematicians from the United States, the United Kingdom, Europe, India and China, these are mainly through the Research Conference series I organize; Random matrices EurAsia, 2016(Macau, Satellite meeting), 2017 (Shanghai, China), 2018 (Pisa, Italy), 2019 (NA), 2020 (Singapore, postponed to April 2022, due

to Covid). These are international conferences, that bring together Mathematicians and Physicists from all over the world (China, Italy, Poland, Russia, United States).
I have so far successfully sponsored a Distinguished Fellowship, for a Professor from the UK who visited the University of Macau for 6 weeks in a collaborative work.
A Professor from China, visited me in Macau, on several occasions on Fellowships.

At the University of Macau, in addition to supervising PhD students, I currently work with a Post-Doc. We study the linear second order odes that appeared naturally in the ladder operator approach to the Hermitean ensembles. These turned out to go beyond the classical Gauss Hypergeometric or the Kummer Confluent Hypergeometric equations and they are a variety of degenerate Heun differential equation. My post-doc and I studied an ode that goes beyond the Landau-Zener problem (described by the parabolic cylinder functions) that models the coupling of a spin-1/2 system to polarized laser beam. This is a tough poblem due to the fact that there are no well developed theory connecting the solutions around each singular points. However, we managed to work out the problem through a combination of analytical and computational means. We continue to pursue problems in PT symmetric quantum mechanics, where degenerate Heun equations appear.

My management duties are; sitting on promotion committees, consist of External member (usually a Chair Professor from Hong Kong), Vice Rector (Research), the Dean of the Faculty of Science and Technology, to discuss the academic performance of candidates for promotion, and vote on the promotion. This is carried out at the University level. At the Department level, I participate in the promotion committee and make recommendations on promotion from Assistant Professor to Associate Professor, also Associate to Professor. I have provided advice for the extension of contract when a Senior Professor reached the age 65.

I provide academic advice to Junior Colleague; commenting on the their written CVs, and recommending to them suitable external referees.

I am a Senior non-residential Fellow of a College in the University of Macau, where I see my tutees from time to time to provide pastoral care, academic care.

At this stage of my career, I feel that having gained extensive experience working in Imperial College and the University of Macau, supervise to successful conclusion 15 PhDs and a number of Masters, I am ready and able to take up this position. The role of Maths teaching, although a demanding job, would extend considerably the range and depth of my Mathematics Teaching activities. Because of Chinese ethnicity, I will have appreciation of the Chinese Culture and Civilization. Furthermore, I hope I would be able to establish new relationship between your School and Institutions in the UK and China, to further promote the School's profile.

To discuss further this matter, I can be contacted via whatspp +85362329546.

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