

Newsletter

from World Scientific

February/March 2019

World Scientific Mourns The Passing Of Our Author Top Mathematician Sir Michael Atiyah

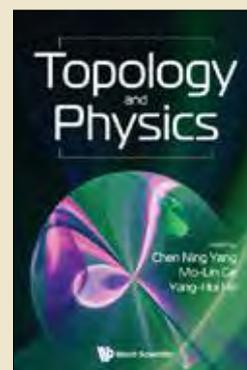
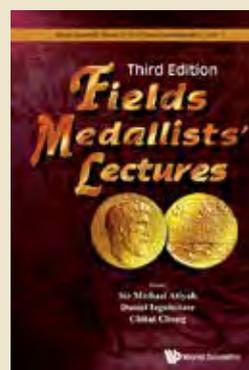


World Scientific mourns the passing of important author and world-renowned mathematician, Sir Michael Atiyah, on 11 January 2019. Best known for his co-development of topological K-theory and the Atiyah-Singer index theorem among other outstanding contributions to geometry and topology, Sir Michael's work has had great influence in fields far and beyond mathematics,

extending to aspects of theoretical physics such as quantum theory and general relativity.

A recipient of numerous awards, including the 1966 Fields Medal, the 1968 Royal Medal of the Royal Society, the 1988 Copley Medal of the Royal Society, and the 2004 Abel Prize of the Norwegian Academy of Arts and Sciences, Sir Michael was a member of notable institutions in the academic arena. He was variously President of the Royal Society 1990-1995, Savilian Professor of Geometry at the University of Oxford, Master of Trinity College at the University of Cambridge, founding Director of the Isaac Newton Institute for Mathematical Sciences, and Honorary Professor in the School of Mathematics at the University of Edinburgh. He was also knighted in 1983, appointed to the Order of Merit in 1992 and made a Grand Officer of the Légion d' honneur in 2011.

As editor of three editions of World Scientific's *Fields Medallists' Lectures*, Sir Michael has ensured the dissemination of major developments in mathematics over past decades and highlighted areas where the greatest progress was made.



- **Fields Medallists' Lectures** (3rd Edition)
World Scientific Series in 21st Century
Mathematics: Volume 1
<https://www.worldscientific.com/worldscibooks/10.1142/9652>



- **Topology and Physics**
<https://www.worldscientific.com/worldscibooks/10.1142/11217>



Readers who wish to access Sir Michael's last published paper are encouraged to purchase a copy of *Topology and Physics*.



World Scientific Remembers World Famous Physicist S.C. Zhang (张首晟)

World-renowned Chinese physicist Professor Zhang Shoucheng passed away on 1 December 2018, at the age of 55. We were deeply shocked and saddened to hear of his passing. Professor Zhang was a tenured professor at Stanford University; a member of the National Academy of Sciences; Foreign Member of the Chinese Academy of Sciences; and a World Scientific author and editorial board member of our journals, *International Journal of Modern Physics B* and *Modern Physics Letters B*.

Continues on page 3

For greater insight into S.C. Zhang and his contributions to physics, readers are encouraged to read Nobel laureate C N Yang's opinion editorial on Prof Zhang on page 3 of the newsletter as well as an exclusive interview with Prof Zhang <https://www.worldscientific.com/doi/10.1142/S0217979218300116> published in the *International Journal of Modern Physics B*, Vol 32, No. 32.

Company News

World Scientific Publishes Singapore Emeritus Senior Minister Goh Chok Tong's Authorised Biography



From left: Mr Max Phua (Managing Director, WSPC), Professor K K Phua (Chairman, WSPC), Mr Peh Shing Huei (Author), PM Lee Hsien Loong, ESM Goh Chok Tong, Professor Tan Eng Chye (President, NUS), Professor Danny Quah (Dean, LKYSPP)

Published by homegrown international publisher World Scientific, a new book documenting the story of Emeritus Senior Minister (ESM) Goh Chok Tong's life and career was launched on Thursday, 8 November 2018 by Singapore Prime Minister Lee Hsien Loong at the Lee Kuan Yew School of Public Policy. The book, titled "*Tall Order: The Goh Chok Tong Story*", is written by Singapore Literature Prize-winning author Peh Shing Huei.

The event was attended by current and former members of the Singapore cabinet, including Deputy Prime Ministers Teo Chee Hean and Tharman Shanmugaratnam. Former President of the Republic of Singapore, Dr Tony Tan also graced the occasion. More than 120 guests were in attendance.

Speaking at the launch, Prime Minister Lee shared that he had known ESM Goh for more than 40 years, but worked more closely after he was posted to the General Staff in 1981. He acknowledged ESM as his mentor and comrade, and expressed his hope for the upcoming changing of guard to be "just as smooth and sure-footed".

Even though Lee Kuan Yew had encouraged him to write, ESM Goh decided even before he became Prime Minister that he would not write any memoirs. However, he changed his mind after long-time grassroots leaders and personal friends suggested an authorised biography. Despite not being a "born politician", he credits his mentors Lee Kuan Yew, Goh Keng Swee, S Rajaratnam, Hon Sui Sen and Lim Kim San for giving him the training and experience needed to run a country. He hopes his story will encourage present and future generations of "technocrats" to serve their country.

Praise for "*Tall Order: The Goh Chok Tong Story*"

"Engaging and thought-provoking insights drawn from the leadership of one of Asia's most eminent statesmen. Emeritus Senior Minister Goh Chok Tong sheds inspiring light on the values, vision and valour of the new Singapore dream — both inclusive and sustainable — in our changing world."

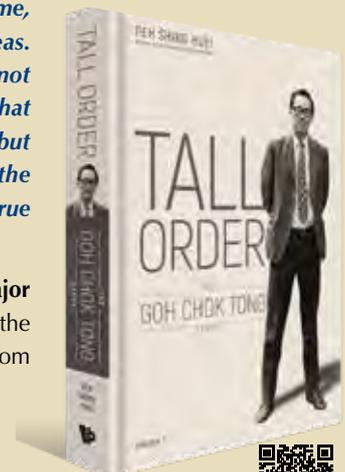
Ban Ki-moon

former United Nations Secretary-General

"Goh Chok Tong is a friend whom I cherish. But, more important than that, he has been instrumental in building a Singapore that is confident of its future at home, and respected widely overseas. Chok Tong views the world not only through the prism of what events mean for Singapore, but also what they presage for the wider world. In short, he is a true Statesman."

Sir John Major

former Prime Minister of the United Kingdom



<https://www.worldscientific.com/worldscibooks/10.1142/11149>



Company News

World Scientific Launches Nobel Prize Winner Sydney Brenner's books



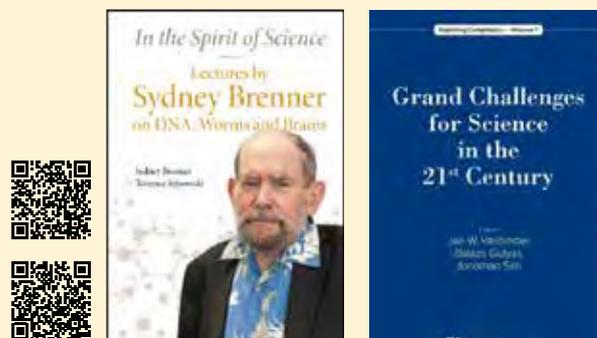
Nobel laureate Sydney Brenner (Physiology or Medicine, 2002) has been at the centre of the development of molecular biology, as a key player in shaping the Laboratory for Molecular Biology in Cambridge into a cradle of research, where pioneering and seminal discoveries in the field have resulted in more than half a dozen Nobel Prizes over half a century.

On 8 November, Professor Brenner launched 2 books published by World Scientific and Nanyang Technological University. The first *In the Spirit of Science*, is co-authored by him, while the other, *Grand Challenges for Science in the 21st Century*, includes a contribution by him.

Brenner's memory is a treasure trove of the history of the field with innumerable anecdotes on other leading scientists in the past 60 years. The lectures contained in the book *In the Spirit of Science* trace historical milestones and recount some of interesting anecdotes.

Grand Challenges for Science in the 21st Century presents lectures by an elite group of speakers including Nobel laureate Sydney Brenner who called on all scientists to adopt a truth-seeking approach and not to be afraid of challenging assumptions.

The launch was held at Flexispace@Medical Library, Lee Kong Chian School of Medicine, and the guest of honour was Professor James Best, Dean, Lee Kong Chian School of Medicine. There were 50 guests in attendance.



<https://www.worldscientific.com/worldscibooks/10.1142/11029>
<https://www.worldscientific.com/worldscibooks/10.1142/11161>

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World Scientific Remembers World Famous Physicist S.C. Zhang (张首晟)

S.C. Zhang: A Physicist of the First Rank by Nobel Laurate Professor C. N. Yang

In condensed matter physics, researchers investigate properties of different kinds of matter: why copper can conduct electricity, while rubber cannot; why water can freeze into ice, but also evaporate into steam; etc. This area of physics has deep relations with applications, with the economic development of the world, and with the daily lives of mankind. Thus it is an especially important area of research. S. C. Zhang has led several revolutionary advances in this area of physics, of which, the most important is in Quantum Spin Hall Effect and related areas.

In 2005–2006, C. L. Kane of the University of Pennsylvania and Zhang independently published theories pointing to the possible existence, in composite matter under proper conditions, of surface electric conductivity, an entirely new phenomenon. These two papers immediately caught the attention of all condensed matter physicists. But which composite matter, under what conditions, would exhibit this remarkable new phenomenon remained a very difficult problem.

SC told me that together with several semiconductor collaborators, he next made calculations for specially-designed quantum wells in composite semiconductors, and published on

December 15 2006, a paper predicting that in a Hg-Te-Cd semiconductor quantum well, there could be surface electric conductivity plus other new important phenomena. Now, there are many types of semiconductors and quantum wells can have many different shapes and dimensions, how did they choose to focus on their specific Hg-Te-Cd quantum well? I think the only answer is: Zhang had deep intuition in the quantum mechanics of semiconductors.

In 2007, Molenkamp of Würzburg University and his experimental group, following Zhang's prediction, tried several kinds of HgTe/(HgCd)Te quantum wells, and created the first example of surface electric conductivity and related phenomena. In November that year, they published, together with Zhang and his student X. L. Qi, a paper announcing this great success. This paper is one of the most important papers in physics in recent years.

It has been the general opinion of all physicists that Kane, Zhang and Molenkamp will receive the Nobel prize in time. Now that Zhang has passed away, I firmly believe Kane and Molenkamp will one day be awarded the Nobel prize.

[An earlier version of this paper, in Chinese, first appeared in *GuangMing Daily* in December 2018.]

Company News

Singapore Deputy Prime Minister Tharman Shanmugaratnam launches World Scientific book, "How Working Together Matters"

On 27 November 2018, Deputy Prime Minister & Coordinating Minister for Economic and Social Policies, Mr Tharman Shanmugaratnam launched World Scientific's latest social science publication, *How Working Together Matters: Adversity, Aspiration, Action*. Senior Minister of State for Defence and Foreign Affairs & Mayor of South East Community Development Council, Dr Maliki Osman, was also present. The launch was attended by 100 invited guests from the public and private sectors as well as academic circles.

Edited by Professor David Chan, Director of the Behavioural Sciences Institute at Singapore Management University, the book is about the art and science of finding solutions to helping families in crisis and making real and lasting positive difference in their lives.

In his speech at the launch, DPM Tharman Shanmugaratnam noted that the experience of helping 1,183 families in need in implementation of the project, which was analysed in the book, showed the importance of both collective action and personal responsibility in the process. Agreeing with a point made in the book's foreword written by Singapore's Prime Minister Lee Hsien Loong, Professor David Chan hopes that lessons documented in the book will be useful for individuals, groups and organisations working together to help make a positive difference in people's lives and to society.



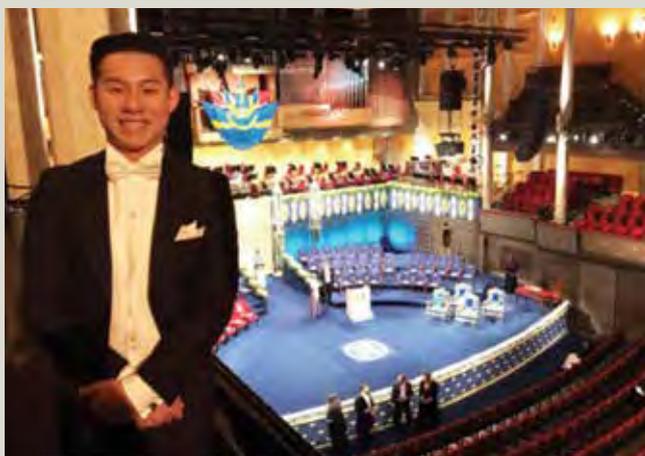
((Second from right) Deputy Prime Minister (DPM) & Coordinating Minister for Economic and Social Policies, Mr Tharman Shanmugaratnam at the launch of "How Working Together Matters: Adversity, Aspiration, Action". PHOTO: BEHAVIOURAL SCIENCES INSTITUTE

More information on the book is available on <https://www.worldscientific.com/worldscibooks/10.1142/11214>.

The event was covered by *Channel News Asia*, *The Straits Times*, and *Today Online*.



Outstanding Junior College Student Recipient of World Scientific Award Represents Singapore at Nobel Award Ceremony



Mr Russell YANG Qi Xun, from NUS High School of Mathematics and Science, representing Singapore at the Nobel Award Ceremony held in Stockholm on 10 December 2018. PHOTO: WORLD SCIENTIFIC

Mr Russell Yang Qi Xun, a NUS High School of Mathematics and Science student, represented Singapore at the Nobel Award Ceremony held in Stockholm on 10 December 2018.

Mr Yang, 18, was selected by a panel of judges comprising eminent scientists and scholars from a shortlist of about 18 qualified candidates drawn up by the Ministry of Education. Jointly awarded annually by World Scientific and The Imperial College Alumni Association of Singapore (ICAAS), the recipient of this **WSPC-ICAAS Most Outstanding Junior College Science Student award** receives full sponsorship for the week-long event.

Mr Yang said, "It is an honour to be Singapore's sole representative in the Stockholm International Youth Science Seminar. Attending the Nobel Prize Ceremony is both a privilege and an eye-opening experience since it is the hallmark of scientific achievement. The global nature of the seminar has broadened my global horizons in science in the context of various societies and cultures. "

For information on Mr Yang's trip to Stockholm, please refer to <https://www.worldscientific.com/doi/10.1142/news20181226.179853/full/>.



For information on the ceremony, please refer to <https://www.nobelprize.org/nobel-prizes-2018/>

Publishing Highlights

Top Book on Topology

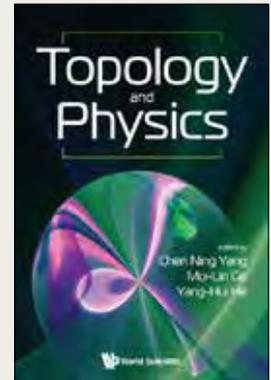
Key Experts Featured: Michael Atiyah, C N Yang, S.C. Zhang, Edward Witten

Topology and Physics

Edited By: **Chen Ning Yang** (Tsinghua University, China), **Mo-Lin Ge** (Chern Institute of Mathematics, China) and **Yang-Hui He** (City, University of London, UK)

Since its birth in Poincaré's seminal 1894 "Analysis Situs", topology has become a cornerstone of mathematics. As with all beautiful mathematical concepts, topology inevitably — resonating with that Wignerian principle of the effectiveness of mathematics in the natural sciences — finds its prominent role in physics. From Chern–Simons theory to topological quantum field theory, from knot invariants to Calabi–Yau compactification in string theory, from spacetime topology in cosmology to the recent Nobel Prize winning work on topological insulators, the interactions between topology and physics have been a triumph over the past few decades. In this eponymous volume, we are honoured to have contributions from an assembly of grand masters of the field, guiding us with their world-renowned expertise on the subject of the interplay between "Topology" and "Physics".

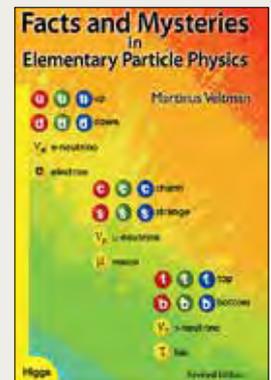
<https://www.worldscientific.com/worldscibooks/10.1142/11217>



Facts and Mysteries in Elementary Particle Physics (Revised Edition)

By **Martinus J G Veltman** (University of Michigan, Ann Arbor, USA & NIKHEF, The Netherlands)

This book provides a comprehensive overview of modern particle physics accessible to anyone with a true passion for wanting to know how the universe works. Facts and Mysteries in Elementary Particle Physics offers incredible insight from an eyewitness and participant in some of the greatest discoveries in 20th century science. From Einstein's theory of relativity to the spectacular discovery of the Higgs particle, this book will fascinate and educate anyone interested in the world of quarks, leptons and gauge theories. Real world and theory meet using Feynman diagrams to solve the problems of infinities and deduce the need for the Higgs boson.



Praise for Facts and Mysteries in Elementary Particle Physics

"Veltman's life spans the history of particle physics, from Antiparticles to Z bosons. So does his crystal clear book, which tells all you want to know about the strange sub-nuclear world and the stranger scientists that study it ... a thrilling tale about the world's tiniest things."

Sheldon Glashow, Nobel laureate, Boston University

"Veltman's ... transparent explanations of the abstract theories of quantum mechanics and special relativity, his lucid accounts of esoteric subjects in particle physics, such as scaling, Higgs particle and renormalizability ... are very impressive. The book will interest anyone who is interested in the view of the physical world held by contemporary fundamental physicists."

T Y Cao, Boston University

"Veltman gives an excellent impression of how science works and how the desire to penetrate into the unknown is what fires the enthusiasm of scientists. He also manages to explain the most abstract intricacies of particle theory without using any mathematics whatsoever ... I can fully recommend this book to students and interested lay readers, who will gain a fascinating insight into the sub-nuclear world — from a theoretical experimental and personal point of view."

Physics World



<https://www.worldscientific.com/worldscibooks/10.1142/10904>

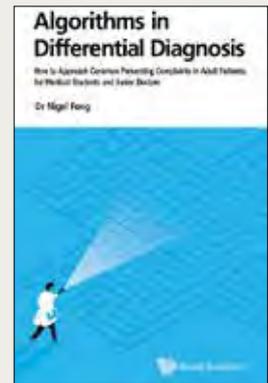
Publishing Highlights

Algorithms in Differential Diagnosis

By **Dr Nigel Fong** (Singapore General Hospital)

World Scientific publishes the much-anticipated book for medical students and first-year doctors who wish to learn how to approach a patient's symptoms, and sharpen their skills of clinical reasoning and diagnosis.

Fifty-four presenting symptoms are discussed, covering approaches and conditions across various medical and surgical disciplines. Each chapter sets out the thought process behind history, examination, and investigations for a symptom, providing a systematic and practical algorithm to distinguish one differential from another. The reader will gain not only a functional approach to patients' presenting complaints, but also learn how to better organize and apply medical knowledge in diagnostic reasoning.



Praise for Algorithms in Differential Diagnosis

"This book has helped to shape how I think about approaching patients. Those who read and understand it will be able to better synthesize the immense amount of medical knowledge expected from us."

Tan Jiekai, Medical student, National University of Singapore

"Other textbooks tend to teach one disease at a time, which is not how it is in the wards. Differential diagnosis is a fundamental skill we need to pick up and this book does the trick."

Lynnette Ng, Medical student, National University of Singapore

"Nigel's Algorithms is a handy gestalt approach to the problems that patients present with, and succinctly provides a scaffolding for students to learn how to diagnose. One of this book's strengths is that it was written at a relatively junior stage of the author's career – he understands the confusion that students have and is thus able to guide the learner through a diagnostic approach much better than someone older. The pairing of a junior author with 20 senior specialist reviewers has ensured both accuracy and approachability."

Dr Ong Thun How, Senior Consultant & Program Director, Respiratory & Critical Care Medicine,
Singapore General Hospital



<https://www.worldscientific.com/worldscibooks/10.1142/10787>

Scale-up Manual

By **Uday Phadke** and **Shailendra Vyakarnam**

Praise for Scale-up Manual

"Over the past 20 years, I have seen entrepreneurs struggle with every aspect of innovation from ideation through company start up to subsequent leadership of maturing companies. The Scale-up Manual brings together a wealth of knowledge from different models that supports the entire commercialisation journey. The authors develop the tools and models [...] and, through their case-study based approach, provide a pathway to convert theory into practice. The Scale-up Manual arrives at a time when governments across the globe are looking to innovation to fuel future economic growth. Whether you are an aspiring entrepreneur, leading an established enterprise or responsible for innovation policy at the national or international level you will benefit from reading this book."

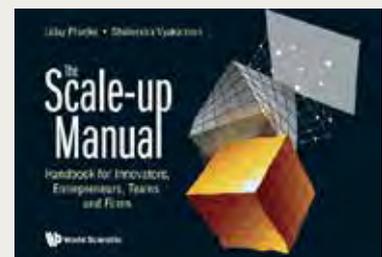
Dr Adrian Ibrahim, Head of Business Development and Technology Transfer, Wellcome Trust Sanger Institute

"Converting ideas into reality requires not only a conceptual framework to understand the overall commercial landscape but also the right tools to build a clear plan for effective implementation. With Camels, Tigers & Unicorns, Phadke and Vyakarnam synthesised and extended a broad spectrum of frameworks for converting ideas into innovations. Now with The Scale-up Manual, the same authors respond to practitioner demand with a focus on 'how to' tools needed by tech and non-tech entrepreneurs alike to identify their exact location on the scale-up journey, diagnose their dominant requirements at each stage and then execute step-by-step the plan emerging from this detailed analysis. The outcomes of a generation of thinking about the often-confusing realities of business growth have been distilled into a robust, accessible toolkit. The resulting Commercialisation Canvas provides a comprehensive overview of the scale-up journey, tailored to each team's exact requirements."

Dr David Gill, Managing Director of St Johns Innovation Centre, Cambridge



<https://www.worldscientific.com/worldscibooks/10.1142/q0176>



Publishing Highlights

The History of Quantum Chromodynamics

By H. Fritzsche



About 70 years ago, many new particles were discovered, in particular the four Δ -resonances, the six hyperons and the four K-mesons. The Δ -resonances, with a mass of about 1230 MeV and with spin (3/2), were observed in pion-nucleon collisions at the cyclotron in the University of Chicago. They are excitations of the nucleons and decay into nucleons and pions.

The hyperons and K-mesons were discovered in cosmic-ray experiments. Six hyperons were observed, the three Σ -hyperons, one Λ -hyperon and the two Ξ -hyperons. There are four K-mesons, two are charged and two are neutral.

Murray Gell-Mann and independently Yuval Ne'eman described the new particles with a symmetry, based on the group SU(3), the group of unitary 3×3 matrices (Gell-Mann – 1962, Ne'eman – 1961). The SU(3)-symmetry is an extension of the isospin symmetry, which was introduced in 1932 by Werner Heisenberg.

The isospin symmetry is described by the group SU(2), the group of unitary 2×2 matrices. The particles are described by representations of SU(2) — the proton and neutron are an isospin doublet, the four Δ -resonances an isospin quadruplet. The three pions are an isospin triplet, the four K-mesons are two isospin doublets.

The simplest representations of the group SU(3) are the singlet, the triplet, the octet and the decuplet. The baryons are octets and

decuplets, the mesons are octets and singlets. The baryon octet contains the two nucleons, the three Σ -hyperons, the Λ -hyperon and the two Ξ -hyperons. The members of the meson octet are the three pions, the η -meson and the four K-mesons.

With particle accelerators also excitations of the Σ -hyperons and of the Ξ -hyperons were discovered. They are analogous to the Δ -resonances. Thus in 1961 nine baryon resonances were known — the four Δ -resonances, the three Σ -resonances and the two Ξ -resonances. These nine particles could not be described by an octet.

Gell-Mann suggested that they should be described by an SU(3)-decuplet, but in this case one particle was missing. He predicted that this particle, which he called " Ω -", should exist. He also estimated the mass of the new particle - about 1680 MeV.

The Ω - particle was observed three years later, in 1964, at the Brookhaven National Laboratory by Nicholas Samios and his group. It has a relatively long lifetime, since it can decay only by the weak interactions – the other nine members of the SU(3) decuplet decay by the strong interaction. The discovery of the Ω — particle implied that the SU(3) symmetry is a correct symmetry. In 1969, Murray Gell-Mann received the Nobel Prize.

[The above abstract and Dr Fritzsche's full paper will be published in the *International Journal of Modern Physics A*]

<https://www.worldscientific.com/worldscinet/ijmpa>
<https://www.worldscientific.com/doi/abs/10.1142/S0217751X19300011>



Reviews

China's Change: The Greatest Show on Earth

By Hugh Peyman

"Through the extraordinary array of people he has known and met over 40 years, Hugh Peyman tells the story of today's China in a way that has never been done before."

Tony Hall, BBC Director-General

"It is rare for a foreigner to understand China from the ground up. Hugh's advantage is that he got to understand China's diaspora before working in China, going through the numbers at the ground level and meeting people engaged in both business and officialdom"

Andrew Sheng, Former Chief Adviser to the China Banking Regulatory Commission, Head of the Hong Kong Securities and Futures Commission and author of *From Asian to Global Financial Crisis*

<https://www.worldscientific.com/worldscibooks/10.1142/10748>



Reviews

Electronic Trading and Blockchain: Yesterday, Today and Tomorrow

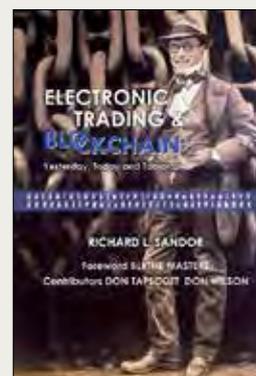
By **Richard L Sandor** (American Financial Exchange, USA & Environmental Financial Products, LLC, USA & University of Chicago Law School, USA)

"Dr Sandor has been at the forefront developing widely-accepted risk management solutions. As a young academic in the 1960's, he was already ahead of the curve on the digitization of markets with early-generation computers. Known throughout the world for pioneering many of the most relied upon instruments and techniques for transforming price risk, he has earned global recognition and is celebrated as the "father of financial futures." Most recently, he has successfully demonstrated how a well-designed market can solve for shortages of food and water, as well as encourage investment in clean air. And he's not resting, as he continues to pioneer new market solutions with blockchain technologies. Any time Dr Sandor shares his perspectives on a topic, the industry takes notice."

Jeffrey C Sprecher

Chairman & CEO, Intercontinental Exchange (ICE) and Chairman, New York Stock Exchange

<https://www.worldscientific.com/worldscibooks/10.1142/10812>



Principles of Quantum Computation and Information A Comprehensive Textbook

By **Giuliano Benenti** (Università degli Studi dell'Insubria, Italy), **Giulio Casati** (Università degli Studi dell'Insubria, Italy), **Davide Rossini** (Università di Pisa, Italy), **Giuliano Strini** (Università di Milano, Italy)

"Thorough introductions to classical computation and irreversibility, and a primer of quantum theory, lead into the heart of this impressive and substantial book. All the topics [...] are explained carefully and in detail. [...] A more wide-ranging, comprehensive, and definite text is hard to imagine."

Michael Berry, University of Bristol, UK

"This [book] is a timely and very comprehensive update in a rapidly developing field, both in theory as well as in the experimental implementation of quantum information processing. [...] All in all, a well-written and commendable textbook, which will prove very valuable both for the novices and the scholars in the fields of quantum computation and information."

Rainer Blatt, Universität Innsbruck and IQOQI Innsbruck, Austria

"The book [...] is an excellent introduction to the fascinating field of quantum information, of great benefit for scientists entering the field and a very useful reference for people already working in it."

Rosario Fazio

The Abdus Salam International Centre for Theoretical Physics, Trieste, Italy

Praise for previous editions:

"This book is, on the whole, well-written and readable. The material is presented concisely, and illustrated with simple examples and exercises [...] It could serve well as the text for an introductory course."

Mathematical Reviews

"The second volume provides a great deal more depth on subjects vital to understanding quantum computers as a possible technology [...]The two volumes of this text are [...] worthy entries, and could serve admirably in a graduate-level introductory course — particularly one with a significant experimental component, or one that also touches on quantum chaos."

Mathematical Reviews

<https://www.worldscientific.com/worldscibooks/10.1142/10909>

