KYOTO PRIZE

June 14, 2019
INAMORI FOUNDATION

Press Release

Announcement of the 2019 Kyoto Prize Laureates

The Inamori Foundation (President: Kazuo Inamori) is pleased to announce the laureates of the 2019 Kyoto Prize, an international award presented to individuals who have contributed significantly to the scientific, cultural, and spiritual betterment of humankind. The Kyoto Prize Presentation Ceremony will be held in Kyoto, Japan on November 10. Each laureate will receive a diploma, the Kyoto Prize medal (20K gold), and prize money of 100 million yen. This year's Prize goes to the following three individuals.

Advanced Technology

Dr. Ching W. Tang Chemist (b. July 23, 1947 / Age 71)

IAS Bank of East Asia Professor,
The Hong Kong University of Science and Technology,
Professor Emeritus, University of Rochester

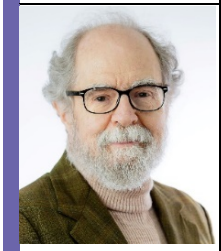
Prize Field: Materials Science and Engineering

Pioneering Contributions to the Birth of High-Efficiency Organic Light-Emitting Diodes and Their Applications

Dr. Tang studied light emission processes in electrically-driven organic materials and invented a new device structure in which two carefully-selected materials were stacked, allowing for high-efficiency light emission at low drive voltages. This pioneering work has led to the practical use of organic light-emitting diodes (OLEDs) and their widespread application in displays and lighting.

Basic Sciences

Dr. James Gunn Astrophysicist (b. October 21, 1938 / Age 80)



Emeritus Eugene Higgins Professor of Astrophysical Sciences, Princeton University

Prize Field: Earth and Planetary Sciences, Astronomy and Astrophysics

Outstanding Contributions to the Elucidation of Cosmic History Based on a Large-Scale Wide-Field Observation

Dr. Gunn led the Sloan Digital Sky Survey, which produced a three-dimensional digital cosmic map encompassing a broad region. He played a leading role in the project, including planning, instrument development, and data analysis, and contributed to the elucidation of the evolutionary history of the universe. He also published many pioneering astrophysical theories. Through these achievements, he has provided us a significant understanding of the universe.

Arts and Philosophy

Mrs. Ariane Mnouchkine Stage Director (b. March 3, 1939 / Age 80)

Founder and Director, Théâtre du Soleil

Prize Field: Theater, Cinema

A Stage Director Who Has Innovated Theatrical Expressions Through Her Original Masterpieces for Over Half a Century

Mrs. Mnouchkine, the founder and director of the Théâtre du Soleil, has been continuously producing masterpieces with historical and political themes. Referring to traditional performances of both the East and the West, she has been innovating theatrical expressions through her collaborative creations based on the methodology of her unique theatrical organization which eschews hierarchical order.

(Age is as of June 14, 2019)

BIOGRAPHY OF THE 2019 KYOTO PRIZE LAUREATE IN ADVANCED TECHNOLOGY

Prize Field: Materials Science and Engineering

Dr. Ching W. Tang

Chemist

Affiliation and Title/Position

IAS Bank of East Asia Professor, The Hong Kong University of Science and Technology
Professor Emeritus, University of Rochester

Brief Biography

1947	Born in Hong Kong
1970	B.S. in Chemistry, The University of British Columbia
1975	Ph.D. in Physical Chemistry, Cornell University
1975–1981	Research Scientist, Eastman Kodak Company
1981–1990	Senior Research Scientist, Eastman Kodak Company
1990–1998	Research Associate, Eastman Kodak Company
1998–2003	Senior Research Associate, Eastman Kodak Company
2003–2006	Distinguished Research Fellow, Eastman Kodak Company
2006–2017	Doris Johns Cherry Professor, Department of Chemical Engineering, University of Rochester
2013–	IAS Bank of East Asia Professor, The Hong Kong University of Science and Technology
2017–	Professor Emeritus, University of Rochester

Selected Awards and Honors

2001	Carothers Award, Delaware Section of American Chemical Society
2001	Jan Rajchman Prize, Society for Information Display
2004	ACS Award for Team Innovation
2005	Humboldt Research Award
2007	IEEE Daniel E. Noble Award for Emerging Technologies
2011	Wolf Prize in Chemistry
2013	Eduard Rhein Technology Award, The Eduard Rhein Foundation
2014	Nick Holonyak, Jr. Award, The Optical Society
2017	IEEE Jun-ichi Nishizawa Medal
2018	C&C Prize
2018	National Inventors Hall of Fame Inductee

Memberships: American Physical Society, Hong Kong Academy of Engineering Sciences, National Academy of Engineering, The Hong Kong Academy of Sciences, The Society for Information Display

ACHIEVEMENTS OF THE 2019 KYOTO PRIZE LAUREATE IN ADVANCED TECHNOLOGY

Prize Field: Materials Science and Engineering

Dr. Ching W. Tang

Pioneering Contributions to the Birth of High-Efficiency Organic Light-Emitting Diodes and Their Applications

In the 1950s, a group of organic materials were found to be semi-conductive and their electrical conductivities were found to increase significantly when dopants were added. It was then discovered in the 1960s that some organic materials emit light when a high voltage is applied across them. Though the discovery of this electroluminescence (EL) triggered much research work to develop organic EL devices, the emission efficiency remained low (about 0.1%), and the drive voltage required for EL remained high (several tens of volts); these problems hampered any practical application of EL. However, in 1987, Dr. Ching W. Tang invented a new EL device structure consisting of a stack of two carefully-selected organic molecular layers. He demonstrated that this structure facilitates an efficient flow of electric current that results in efficient light emission from the interface region between the two layers (1), even when the applied voltage is set as low as several volts. This innovation paved the way for the practical application of organic EL devices, also known as organic light emitting diodes (OLEDs).

Dr. Tang's new device structure consists of an aromatic diamine hole transport layer, in which the holes carry the current, and an 8-hydroxyquinoline aluminum (Alq) electron transport layer, in which the current is carried by the electrons. When a voltage is applied across the device, holes are injected from the anode into the aromatic diamine layer, while electrons are injected from the cathode into the Alq layer. These electrons and holes recombine with each other resulting in light emission with an excellent efficiency in excess of 1%. Dr. Tang set the hole transport layer as thin as 75 nm and the electron transport layer as thin as 60 nm in order to reduce the electrical resistance of the device; it allowed the device to be driven by a voltage of less than 10 V. Moreover, the cathode on the Alq layer was made using a magnesium-silver alloy to ensure both efficient electron injection and chemical stability (1). To increase the light emission efficiency of OLEDs and to control the wavelength of the light they emit, Dr. Tang also invented a more advanced device structure in which a part of the Alq layer was doped with highly fluorescent molecules. By optimizing the position of the doped layer and its dopant concentration, he achieved a five-fold increase in the efficiency and spectral control of the emitted light (2).

These works accelerated the development of new materials and device structures for OLEDs, resulting in substantial improvements in their efficiency and reliability; they have enabled the practical application of OLEDs and led to their widespread use in displays and lighting.

Dr. Tang invented the basic structure of OLEDs to drastically raise their efficiency on the basis of academic studies on organic materials. His pioneering works have enabled the practical use of OLEDs and their applications and constitute a clearly outstanding

contribution to the fields of materials science and electronics. Indeed, Dr. Tang is truly worthy of receiving the Kyoto Prize.

References

(1) Tang CW & Van Slyke SA (1987) Organic electroluminescent diodes. *Applied Physics Letters* **51**: 913–915.

(2) Tang CW *et al.* (1989) Electroluminescence of doped organic thin films. *Journal of Applied Physics* **65**: 3610–3616.

BIOGRAPHY OF THE 2019 KYOTO PRIZE LAUREATE IN BASIC SCIENCES

Prize Field: Earth and Planetary Sciences, Astronomy and Astrophysics

Dr. James Gunn

Astrophysicist

Affiliation and Title/Position

Emeritus Eugene Higgins Professor of Astrophysical Sciences, Princeton University

Brief Biography

1938	Born in Livingston, Texas, U.S.A.
1965	Ph.D. in Astronomy and Physics, California Institute of Technology
1966–1968	Senior Space Scientist, Jet Propulsion Laboratory, NASA
1968–1970	Assistant Professor, Princeton University
1970–1972	Assistant Professor, California Institute of Technology
1972–1980	Professor, California Institute of Technology
1980–2011	Eugene Higgins Professor of Astrophysical Sciences, Princeton University
1991–2008	Project Scientist, Sloan Digital Sky Survey
2011–	Emeritus Eugene Higgins Professor of Astrophysical Sciences, Princeton University

Selected Awards and Honors

1988	Dannie Heineman Prize for Astrophysics
1994	Gold Medal, Royal Astronomical Society
2001	Petrie Prize Lecture, Canadian Astronomical Society
2002	Joseph Weber Award for Astronomical Instrumentation, American Astronomical Society
2005	Crafoord Prize in Astronomy
2005	Gruber Prize in Cosmology
2008	National Medal of Science
2013	Catherine Wolfe Bruce Gold Medal, Astronomical Society of the Pacific

Memberships: American Astronomical Society, American Philosophical Society, National Academy of Sciences

ACHIEVEMENTS OF THE 2019 KYOTO PRIZE LAUREATE IN BASIC SCIENCES

Prize Field: Earth and Planetary Sciences, Astronomy and Astrophysics

Dr. James Gunn

Outstanding Contributions to the Elucidation of Cosmic History Based on a Large-Scale Wide-Field Observation

Dr. James Gunn designed the Sloan Digital Sky Survey (SDSS) project, which produced a three-dimensional digital cosmic map through a survey of a broad region of the universe. He assumed a leading role in nearly all areas—including the development of observation instruments, data analysis software, a framework for data publication, and scientific analysis. Observational cosmology has developed along two strategies: one is to observe distant (past) individual celestial bodies through the Hubble Space Telescope and large ground-based telescopes, and the other is to observe many celestial bodies in a broad region to deduce an overview of the universe. Dr. Gunn led the SDSS, which went on to be a representative project for the latter strategy. It produced an enormous amount of precise observational data and innovatively deepened our understanding of cosmic history and the properties of various celestial bodies. Furthermore, it successfully determined the parameters of the expanding universe with unprecedented precision.

Dr. Gunn proposed the SDSS project (1) by designing a 2.5-m wide-field telescope that served as the backbone of the project (2), a sensitive ultra-large mosaic CCD camera (3), and a multi-object spectrograph that enabled the simultaneous measurement of 640 celestial bodies (4). This project commenced in 1992 with seven U.S. institutions and a Japanese group, and observations began in 2000. As observational data and research accomplishments were published, the number of participating institutions increased to 25. By 2009, 230 million celestial bodies were cataloged, and the spectra of 930,000 galaxies, 120,000 quasars, and 460,000 stars were obtained (5). Through the publication of the SDSS astronomical catalog, including a homogeneous and overwhelming amount of information, many discoveries were made. Thus, the SDSS is now regarded as the most successful project in the history of observational astronomy.

Major scientific achievements of the SDSS include the production of a three-dimensional cosmic map of galaxies covering one-fourth of the sky as far as 2.5 billion light years away; the elucidation of the large-scale structure of the universe (6–8); and discoveries of numerous distant quasars (9), gravitational lensing phenomena (10), and new populations of low-temperature brown dwarfs (11).

The data on galaxy distribution obtained by the SDSS were combined with data on the temperature fluctuation of cosmic microwave background radiation to reveal that the fraction of normal matter in the universe is less than 5%, whereas the rest of the universe is composed of dark matter (approximately 25%) and dark energy (approximately 70%) (6). Today, this finding has been established as a standard model of the universe. For further investigation of dark matter and dark energy and elucidation of the origin of the structure of the universe, the SDSS provides fundamental data to the cutting-edge research that

connects particle physics and cosmology.

Dr. Gunn not only led the SDSS, but also published many pioneering astrophysical theories (12), including a method that determines the degree of ionization of the past universe (13). He has also made significant contributions to the development of various innovative observation instruments. As modern astronomy research has progressively become fragmented, Dr. Gunn is a rare astronomer who has produced outstanding achievements in theory, observation, and instrument development. Dr. Gunn is trusted by researchers and engineers worldwide owing to his leadership in a large-scale survey that led to a breakthrough in astronomical observations and made a significant contribution to our understanding of the universe. He is, without a doubt, a worthy recipient of the Kyoto Prize.

References

(1) York DG, *et al.* (2000) The Sloan Digital Sky Survey: technical summary. *The Astronomical Journal* **120**: 1579–1587

(2) Gunn JE, *et al.* (1998) The 2.5 m telescope of the Sloan Digital Sky Survey. *The Astronomical Journal* **131**: 2332–2359.

(3) Gunn JE, *et al.* (1998) The Sloan Digital Sky Survey photometric camera. *The Astronomical Journal* **116**: 3040–3081.

(4) Smee SA, *et al.* (2013) The multi-object, fiber-fed, spectrographs for the Sloan Digital Sky Survey and the baryon oscillation spectroscopic survey. *The Astronomical Journal* **146**: 32.

(5) Abazajian KN, *et al.* (2009) The seventh data release of the Sloan Digital Sky Survey. *The Astrophysical Journal Supplement Series* **182**: 543–558.

(6) Tegmark M, *et al.* (2004) Cosmological parameters from SDSS and WMAP. *Physical Review D* **69**: 103501.

(7) Eisenstein DJ, *et al.* (2005) Detection of the baryon acoustic peak in the large-scale correlation function of SDSS luminous red galaxies. *The Astrophysical Journal* **633**: 560–574.

(8) Becker RH, *et al.* (2001) Evidence for reionization at z~6: detection of a Gunn-Peterson trough in a z=6.28 quasar. *The Astronomical Journal* **122**: 2850–2857.

(9) Fan X, *et al.* (2001) High-redshift quasars found in Sloan Digital Sky Survey commissioning data. IV. Luminosity function from the fall equatorial stripe sample. *The Astronomical Journal* **121**: 54–65.

(10) Oguri M, *et al.* (2006) The Sloan Digital Sky Survey quasar lens search. I. Candidate selection algorithm. *The Astronomical Journal* **132**: 999–1013.

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(13) Gunn JE & Peterson BA (1965) On the density of neutral hydrogen in intergalactic space. *The Astrophysical Journal* **142**: 1633–1641.

BIOGRAPHY OF THE 2019 KYOTO PRIZE LAUREATE IN ARTS AND PHILOSOPHY

Prize Field: Theater, Cinema

Mrs. Ariane Mnouchkine

Stage Director

Affiliation and Title/Position

Founder and Director, Théâtre du Soleil

Brief Biography

1939	Born in Boulogne-Billancourt, France
late 1950s	Joined the Oxford University Dramatic Society and the Experimental Theatrical Club
1959	Established the Association Théâtrale des Étudiants de Paris when studying at the Sorbonne
1964	Founded the Théâtre du Soleil
1970	The Théâtre du Soleil moved into the Cartoucherie of Vincennes
1984	Started the collaboration with Hélène Cixous
2005	Held a workshop and helped to create the Théâtre Aftaab in Kabul

Selected Awards and Honors

1987	Europe Theatre Prize
1993	Special Citation of Obie Awards
2005	Honorary Doctor, Roma Tre University
2007	Golden Lion for Lifetime Achievement, Venice Biennale
2008	Honorary Doctor, University of Oxford
2009	International Ibsen Award
2012	International Stanislavsky Prize
2015	Pablo Neruda Order of Artistic and Cultural Merit (Chile)
2017	Goethe Prize of the City of Frankfurt am Main

Selected Works

1964	*Les Petits Bourgeois* (Maxim Gorky)
1967	*La Cuisine* (Arnold Wesker)
1970	*1789, la révolution doit s'arrêter à la perfection du bonheur*
1975	*L'Âge d'or*
1981	*Richard II* (William Shakespeare)
1985	*L'Histoire terrible mais inachevée de Norodom Sihanouk, roi du Cambodge*, (Hélène Cixous)
1987	*L'Indiade ou l'Inde de leurs rêves* (Hélène Cixous)
1990–92	*Les Atrides: Iphigénie à Aulis* (Euripides), *Agamemnon, Les Choéphores, Les Euménides* (Aeschylus)
1999	*Tambours sur la digue* (Hélène Cixous)
2003	*Le Dernier Caravansérail (Odyssées)*
2006	*Les Éphémères*
2010	*Les Naufragés du Fol Espoir* (with Hélène Cixous)
2016	*Une Chambre en Inde*

ACHIEVEMENTS OF THE 2019 KYOTO PRIZE LAUREATE IN ARTS AND PHILOSOPHY

Prize Field: Theater, Cinema

Mrs. Ariane Mnouchkine

A Stage Director Who Has Innovated Theatrical Expressions Through Her Original Masterpieces for Over Half a Century

Mrs. Ariane Mnouchkine has led the Théâtre du Soleil, a theater company she founded in 1964, for over half a century, and has continuously produced internationally acclaimed masterpieces. At the root of her superb talent lies a strong belief that theater is a form of art that should be collaboratively perceived, created, and enjoyed. She has gathered diverse talents and fostered their high mentality and rampant creativity by exploring and developing their latent skills and imaginations.

While producing for the stage, Mrs. Mnouchkine first inquired what theater is or should be and reconsidered its basic principles. This resulted in her original, hierarchy-free theatrical organization with its unique methodology of stage creation. She also considered the audience to be an important member of the "creators" indispensable to theater and attempted to build strong relationships between performer, director, and audience. Since the Théâtre du Soleil started its activities in the Cartoucherie (originally an ammunition factory transformed into a playhouse) in the outskirts of Paris, its performances have been appreciated like festive topos where all kinds of people encountered one another. It could be said that the Théâtre du Soleil embodied the ideal of "public theater."

In order to keep her audiences emotionally engaged, Mrs. Mnouchkine pursued a theatrical method that emphasized physicality by referring to traditional performances such as circus, commedia dell'arte, Japanese Noh, Kabuki, Bunraku, and Indian Kathakali. She reconstructed them using modern sensibilities and explored a method of utilizing actors' improvisation techniques, which culminated in her *Tambours sur la digue* (*Drums on the Dam*), which was inspired by Bunraku. In this work, she attempted to create a comprehensive art form that blended theater with various other genres such as dance, music, and literature. In experimental productions within the field of contemporary theater, her achievements have been remarkable.

In the early 1980s, she produced a cycle of three Shakespeare plays starting with *Richard II* (1981) and demonstrated her deep insight and superb directorial skills in her approach to classical plays. As in her prior works, *1789, la révolution doit s'arrêter à la perfection du bonheur* (*1789 or The Revolution Must Only Stop at the Perfection of Happiness*) (1970) and *Méphisto* (*Mephisto*) (1979), she took a novel view of her own history along with those of her contemporaries and tried to shed new light on the chaotic darkness that plagued the modern age. Mrs. Mnouchkine preserved a reasonable amount of entertainment value while also strongly warning against the contemporary history and politics in *L'Histoire terrible mais inachevée de Norodom Sihanouk, roi du Cambodge* (*The*

Terrible but Unfinished Story of Norodom Sihanouk, King of Cambodia) (1985) written by Hélène Cixous, featuring Cambodian genocide through the epic, *Et soudain des nuits d'éveil* (*And Suddenly Wakeful Nights*) (1997), featuring Tibet under oppression, and *Le Dernier Caravansérail* (*The Last Caravanserai*) (2003), depicting the hardships of refugees through their numerous testimonies.

All her theatrical activities are motivated by her strong determination to be involved with contemporary politics and society, and that is why she ventured as far as India and Afghanistan to hold workshops and instruct local actors. The Théâtre Aftaab, which was formed during her workshop in Kabul, has been active for more than a decade. Over several generations of actors, the Théâtre du Soleil has also achieved great success in fostering numerous multinational actors.

Press Release

EVENT SCHEDULE OF THE 2019 KYOTO PRIZE

◆ WELCOME RECEPTION

Sat., November 9, 2019 / Kyoto Hotel Okura

The welcome reception and dinner will be hosted by the Kyoto Prefectural Government, the Kyoto City Government and the Inamori Foundation in honor of the laureates.

◆ PRIZE PRESENTATION CEREMONY

Sun., November 10, 2019 / Kyoto International Conference Center

◆ JOINT PRESS CONFERENCE

Sun., November 10, 2019 / Kyoto International Conference Center

A joint press conference will be held with the participation of the laureates right after the Presentation Ceremony.

◆ BANQUET

Sun., November 10, 2019 / Grand Prince Hotel Kyoto

◆ COMMEMORATIVE LECTURES

Mon., November 11, 2019 / Kyoto International Conference Center

The laureates will talk about their views on life and personal philosophies.

◆ WORKSHOPS

Tue., November 12, 2019– / Date and Place TBA

Workshops for each of the categories will be held in the participation of the laureates, scholars and experts at respective venues.

◆ KYOTO PRIZE LAUREATE LECTURES IN KAGOSHIMA

Sat., November 16, 2019 / Houzan Hall (Kagoshima Prefectural Culture Center)

Since 2014, the Kyoto Prize 30th anniversary, Kyoto Prize Laureate Lectures in Kagoshima have been held by the Kyoto Prize Laureate Lectures Committee, composed of Kagoshima Prefecture, Kagoshima City, Kagoshima University, and Kagoshima Chamber of Commerce and Industry. This program aims to promote cultural and academic interest among Kagoshima citizens through the opportunity to meet with the world's leading researchers and artists.

◆ KYOTO PRIZE SYMPOSIUM IN U. S. A.

Tue., March 17–Thu., March 19, 2020 / San Diego, California, U.S.A.

The locally-based Kyoto Symposium Organization and co-host universities host public lectures by the Kyoto Prize laureates of the previous year, as well as a gala dinner. Having been held since 2002, the Kyoto Prize Symposium is now a widely-supported annual event in San Diego.

◆ KYOTO PRIZE AT OXFORD

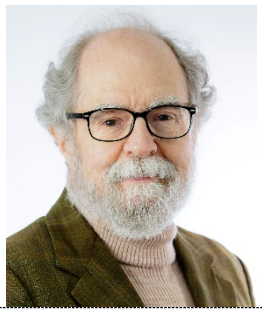
Tue., May 12, Wed., May 13, 2020 / The University of Oxford, U.K.

This is an annual event held and organized by the Blavatnik School of Government (BSG) of the University of Oxford, hosting public lectures by the Kyoto Prize laureates of the previous year and a panel discussion by the laureates and Dean of BSG. The University of Oxford will continue to provide a platform for the Kyoto Prize to increase its presence on the European and the global scene. The series of Kyoto Prize events for the laureates of a particular year conclude with this event in Oxford.

Press Release

THE 2019 KYOTO PRIZE LAUREATES
PICTURES FOR PUBLICATION

The following picture are available on request for your publication's use. Please tell us the photo number you wish to use, as well as your contact information: 1. your name, 2. company name, 3. affiliation and title in the company, 4. phone number and 5. name of publication (date of issue if possible); by E-mail to **press@inamori-f.or.jp**. We will then forward to you the URL and password for downloads.

Portrait pictures of the 2019 Kyoto Prize laureates		
Advanced Technology **Dr. Ching W. Tang**	Basic Sciences **Dr. James Gunn**	Arts and Philosophy **Mrs. Ariane Mnouchkine**
☐ A1	☐ B1	☐ C1
		

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Press Release

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