

2019 Subrahmanyan Chandrasekhar Prize of Plasma Physics

The Division of Plasma Physics (DPP) under the Association of Asia-Pacific Physical Societies (AAPPS) has selected Liu Chen (China) and Kazunari Shibata (Japan) as the 2019 Laureates of the Subrahmanyan Chandrasekhar Prize of Plasma Physics. The 2019 Selection Committee comprised of leading plasma physicists, including Ravindra Kumar (Tata Institute of Fundamental Research, Mumbai, India) and Gadiyara Chakrapani Anupama (Indian Institute of Astrophysics, Bengaluru, India). The award ceremonies for the two laureates are scheduled to take place during the 14th Asia-Pacific Physics Conference in Malaysia during 17–22 November 2019 (this Conference series is held once in three years; <http://apcc2019.ifm.org.my/>).

The citations are as follows. Liu Chen: ‘For his pioneering and seminal theoretical contributions to physics of both magnetic fusion and space plasmas; including, notably, geomagnetic pulsation theory, nonlinear gyrokinetic theory, Alfvén wave heating and kinetic Alfvén waves, toroidal Alfvén eigen modes, “fishbone” and energetic particle modes, and excitation of zonal flow in toroidal plasmas.’ Kazunari Shibata: ‘For his pioneering and seminal contributions in solar and astrophysical magnetohydrodynamics (MHD), including the first non-steady MHD numerical simulations of astrophysical jets from magnetic accretion disks, the discovery of coronal X-ray jets and chromospheric anemone jets in the solar atmosphere and theories and numerical simulations for solar jets and mass ejections based on the MHD reconnection mechanism, his pioneering proposal of plasmoid-induced reconnection and fractal reconnection, and his suggestion that superflares, observed on Sun-like stars, may also occur on the Sun.’ The Prize was founded in 2014 by the AAPPS-DPP and is awarded annually for seminal contribution in the field of plasma physics. It is named in honour of the Nobel laureate Subrahmanyan Chandrasekhar¹. The previous laureates are 2014: Setsuo Ichimaru; 2015: Predhiman Krishan Kaw; 2016: Donald Blair Melrose; 2017: Chio Zong Cheng and Lou-Chuang Lee; 2018: Toshiki Tajima.

Kaw is the only Indian to have received this prize^{2,3}.

Chen is widely acknowledged for his groundbreaking contributions to the foundations of burning plasmas that are magnetically confined in toroidal systems⁴. This line of work is crucial in the context of the upcoming International Thermonuclear Experimental Reactor in Cadarache, France (<https://www.iter.org/>). Chen is considered one of the very few scientists who established the foundations for the understanding of the challenging new physics, which will be the key to solving controlled thermonuclear fusion problems and will eventually shed light on the path to the first thermonuclear reactor⁵. He is the founder and Director of the Institute for Fusion Theory and Simulation at Zhejiang University, Hangzhou, China. He is the recipient of the John Dawson Prize for excellence in plasma physics research by the American Physical Society (2004), Hannes Alfvén Prize from the European Physical Society (2008) and the James Clerk Maxwell Prize of the American Physical Society (2012).

Shibata discovered the physical origin of astrophysical jets in collaboration with Yutaka Uchida⁶. He further established that the same mechanism is responsible for the relativistic jets from black holes. The magnetic reconnection model developed by Shibata is able to explain a variety of jets, solar flares and even corona mass ejections. This unified model has revolutionized the understanding of solar eruptions⁷. Shibata is the Director of Kwasan and Hida Observatory, Japan. He has received the Chushiro Hayashi Prize from the Astronomical Society of Japan (2001).

Along with the Subrahmanyan Chandrasekhar Prize of Plasma Physics, there are other awards instituted by AAPPS-DPP, including the Young Researcher Award (established in 2016 for the age group: 30–40 yrs) and U30 Scientist and Student Award (established in 2018 for the age group under 30 yrs). Indians have been faring well in the aforementioned plasma prizes. Dhanya Mahalingam Balaram received Young Researcher Award in 2016. Gopal Hazra and Laisram Modhuchandra Singh received the

U30 Award in 2018. The inaugural AAPPS-DPP Plasma Innovation Prize (in recognition for seminal/pioneering contributions in the field of plasma applications, focusing on impacts on industry, established in 2019) has been awarded to Roderick William Boswell of the Australian National University¹. The citation is as follows: ‘For wide-ranging contributions to fundamental plasma physics and applications to terrestrial and space industries, in particular for discovery and invention of high-density low pressure radiofrequency plasma source called a “helicon plasma source”, with broad and significant impact on low-temperature plasma physics, plasma processing for microelectronics represented by plasma etching and focused ion beam source, and plasma thrusters, in which he exerted leadership to pioneer new scientific research fields and industrial applications.’ Boswell’s contributions to the fields of basic and applied plasma physics led to high density helicon sources, which are now being used worldwide for surface treatments, innovative space propulsion systems and in numerical simulations for modelling plasma processing discharges. He has also contributed to the fields of space science, plasma etching and deposition for micro/opto-electronics and more recently, for fuel cells and the hydrogen economy.

- <http://aappsdp.org/AAPPSDPP/index.html>
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