The 2021 Subrahmanyan Chandrasekhar Prize of Plasma Physics

The Division of Plasma Physics (DPP) under the Association of Asia-Pacific Physical Societies (AAPPS) has selected Taik Soo Hahm (Seoul National University, Seoul, Korea) as the 2021 Laureate of the Subrahmanyan Chandrasekhar Prize of Plasma Physics. The 2021 Selection Committee consisted of leading plasma physicists, including Amita Das (Indian Institute of Technology (IIT), Delhi) and Sudeep Bhattacharjee (IIT, Kanpur). The certificate and medal were awarded virtually at the Fifth Asia-Pacific Conference on Plasma Physics (AAPPS–DPP2021; held online this year due to the coronavirus pandemic; http://aappsdpp.org/DPP2021/index.html) during 26 September–1 October 2021. The Prize named in honour of Nobel laureate Subrahmanyan Chandrasekhar was founded in 2014 by AAPPS–DPP and is awarded annually for seminal contributions in the field of plasma physics[1]. The previous laureates are Setsuo Ichimaru (2014), Predhiman Krishan Kaw (2015), Donald Blair Melrose (2016), Chio Zong Cheng and Lou-Chuang Lee (2017), Toshiki Tajima (2018), Liu Chen and Kazunari Shibata (2019) and Hyeon Keo Park (2020). Kaw is the only Indian to have received this prize so far[2,3].

The diverse contributions of Hahm are recognized by the following citation: 'For his outstanding contribution to the understanding of turbulence and confinement physics in tokamak plasmas, i.e. notably, flow shearing effects and non-local transport processes, as well as to the pioneering development of modern nonlinear gyrokinetic theories.'

Hahm is the second Korean laureate of this Prize. He is recognized for his fundamental contributions to several areas of magnetic fusion plasma research, including modern nonlinear gyrokinetic theory, the shear flow reduction of plasma turbulence, and non-diffusive transport among others. Hahm and his collaborators showed that $E \times B$ flow sheer can be used to suppress plasma turbulence. He was one of the first scientists to apply the idea of 'self-organized criticality' to magnetic fusion as a nonlocal transport mechanism. With this diversity, he played a pivotal role in bridging the theory, gyrokinetic simulations and experimental measurements[4,5]. Hahm is based at the Department of Nuclear Engineering, College of Engineering, Seoul National University. He served as the Director of Advanced Technology Research Center, Korea (2015–2017). He is also the Chief Editor of *Reviews of Modern Plasma Physics*. Hahm served as the Chairman of the 2015 Selection Committee, which awarded the 2015 Plasma Prize to Kaw[2].

Along with the Subrahmanyan Chandrasekhar Prize of Plasma Physics, there are other awards instituted by AAPPS–DPP, including the Plasma Innovation Prize (in recognition of seminal/pioneering contributions in the field of plasma applications, focusing on impacts on industry, established in 2019). The inaugural Prize was given to Roderick William Boswell in 2019. The 2020 recipient was Masaru Hori. The 2021 Prize has been awarded to Anthony (Tony) Bruce Murphy (Australia). The citation reads as follows: 'For his outstanding contributions to research and development in computational modelling of thermal plasmas, in particular, for critical contributions to the world's first commercial plasma waste treatment process – PLASCON for development of arc welding software – ArcWeld – that has been transferred to automotive and rail manufacturers; and for calculation of thermophysical properties, including a new treatment of diffusion, of thermal plasmas that have been adopted internationally in computational models of industrial plasma processes.' The chief contributions of Murphy are application of thermal plasma (also called as low temperature plasma) distinct from the very high temperature thermonuclear fusion plasma. Such plasma states can be produced by industrial techniques, including atmospheric arcs, sparks and flames. Murphy developed a waste-treatment process to destroy hazardous chemicals. The commercially operated plants known as PLASCON/PyroPlas have been used for three decades, destroying ozone-depleting substances, greenhouse gases and toxic organic chemicals. Murphy developed a welding simulation software which integrates the arc plasma in the computational model. This software known as ArcWeld operates from commonly available computers. The software leads to reduction in experimental benchmarking and enhances the reliability. It is now used extensively by the automotive and rail manufacturers. The results arising from Murphy's calculations of the thermophysical properties of plasmas are used as a standard in the industry and academia[6]. Murphy has been with the Commonwealth Scientific and Industrial Research Organisation, Australia, since 1989 and currently leads the Materials and Process Modelling team there. He is also Editor-in-Chief of *Plasma Chemistry and Plasma Processing*.

The other awards instituted by AAPPS–DPP are the Young Researcher Award (established in 2016 for the age group 30–40 years), U30 Doctoral Scientist/Student Award (established in 2018 for the age group under 30 years) and the Poster Prize (established in 2018 and selected from the Annual Asia-Pacific Conferences on Plasma Physics). Indians have been faring well in the aforementioned prizes. Dhanya Mahalingam Balaram was one of the four recipients of the inaugural Young Researcher Award (in 2016). Gopal Hazra and Laishram Modhuchandra Singh were two of the six recipients of the inaugural U30 Award (in 2018). Among the six U30 Award recipients in 2019, there were two Indians – Sudip Mandal and Rupak Mukherjee. The recipients of the inaugural Poster Prize (in 2018) were Punit Kumar, Teena Jangid and Ram Prasad Prajapati. The recipients of the Poster Prize for 2020 were Deepika Behmani, Sushanta Barman and Swati Swagatika Mishra. For the 2021 Poster Prize, Abhijit Sen (Institute for Plasma Research (IPR), Gandhinagar) served as the Chair of the Selection Committee. The Indian recipients were Swati Dahiya (IPR), Kalyani Barman (IIT, Kanpur) and Shrish Raj (IPR).

1. http://aappsdpp.org/AAPPSDPPF/index.html
2. Khan, S. A., *Curr. Sci*., 2016, **111**(3), 458; 2019, **117**(10), 1561; 2020, **119**(9), 1401.
3. John, P. I. and Sen, A., *Curr. Sci*., 2017, **113**(2), 337–338.
4. Hahm, T. S. and Burrell, K. H., *Phys. Plasmas*, 1995, **2**(5), 1648–1651; https://doi.org/10.1063/1.871313.
5. Diamond, P. H., Itoh, S. I., Itoh, K. and Hahm, T. S., *Plasma Phys. Control. Fusion*, 2005, **47**(5), R35; https://doi.org/10.1088/0741-3335/47/5/R01.
6. Murphy, A. B. and Eugene, T., *J. Phys. D*, 2014, **47**(29), 295202; https://doi.org/10.1088/0022-3727/47/29/295202.

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