

AAPPS-DPP Plasma Innovation Prize – Dr Keishi Sakamoto is selected as Seventh Laureate (2025) –

The Division of Plasma Physics (CEO: Mitsuru Kikuchi, Chair: Rajdeep S. Rawat) under the Association of Asia Pacific Physical Societies (President: Hyoungh Joon Choi) selected Dr Keishi Sakamoto of Kyoto Fusioneering as the 7th Laureate of AAPPS-DPP Plasma Innovation Prize, which is awarded to scientists who have made seminal / pioneering contributions in the field of plasma applications, focusing on impacts on industry.

Citations:

Keishi Sakamoto: *For his outstanding contributions to the development and commercialization of gyrotron and mm-wave facilities and demonstration for 1 MW gyrotron oscillation, electron spent beam energy recovery and diamond output window for delivering high-efficiency power of megawatt-class gyrotrons, that have helped elucidate fusion plasma devices; for commercialization of gyrotron for plasma heating and demonstration for a practical energy source, fusion energy.*



AAPPS-DPP Innovation Prize

*is awarded by Division of Plasma Physics, AAPPS
for outstanding contribution to the field of Plasma Applications.
This award is partially sponsored by MDPI AG.
The 2025 Prize is awarded to*

Keishi Sakamoto

For his outstanding contributions to the development and commercialization of gyrotron and mm-wave facilities and demonstration for 1 MW gyrotron oscillation, electron spent beam energy recovery and diamond output window for delivering high-efficiency power of megawatt-class gyrotrons, that have helped elucidate fusion plasma devices; for commercialization of gyrotron for plasma heating and demonstration for a practical energy source, fusion energy.



Rajdeep S. Rawat
Chair of DPP



Se Youn Moon
Chair of Selection Committee

22 September, 2025

Certificates of 2025 Plasma Innovation Prize

Certificate, medal and cash prize will be given at the 9th Asia-Pacific Conference on Plasma Physics (AAPPS-DPP2025) Sept. 21-26, 2025 at Fukuoka International Congress Center.

Contact point : AAPPS-DPP Association Inc. : Representative Director and CEO, Mitsuru Kikuchi,

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On the achievements of Dr Keishi Sakamoto



Dr.Keishi Sakamoto

Dr.Keishi Sakamoto was born in Fukuoka, Japan in 1957 and received his PhD in Science at Kyushu University, Japan. Since 1981, he has been a research scientist for plasma heating technology at Japan Atomic Energy Institute (whose activity is taken over by National Institute for Quantum Science and Technology). He is a leader of research and development team of high power mm wave source “gyrotron” and accomplished many innovative achievements on Megawatt gyrotron, such as high order volume mode oscillation, energy recovery, diamond window and hard self-excitation mode, leading world gyrotrons for Fusion Energy. He moved to start-up company Kyoto Fusioneering Ltd (KF). since 2021, and as CTO of KF he is contributing to the plasma and fusion communities by developing and delivering high power gyrotrons to the

world-wide ECH systems of institutes and fusion start-up companies. And, he served as a guest professor of University of Tsukuba, National Institute of Fusion Science, Fukui University and Kyoto University. In addition, he won many prizes including EPS Plasma Physics Innovation Prize, IEEE John R.Pierce Award, The commendation for Science and Technology by the minister of Education, Culture, Sports, Science and Technology (Japanese government). The followings are his major achievement.

Firstly, He achieved 50% conversion efficiency on the 0.5MW 110GHz gyrotron from the DC input power to the mm-wave power by employing the energy recovery system. Previously, the gyrotron efficiency had been typically 20~30%. After this success, the gyrotron and electron cyclotron plasma heating were considered as a major heating tool for large sized magnetic confinement device such as ITER. Efficiency improvement brought about the significant reduction of power supply capacity, power deposition to the collector, and cooling system capacity. This gyrotron was selected as “Essential Historical Materials for Science and Technology” by National Museum of Nature and Science of Japan. (K.Sakamoto, et al., Phys.Lev.Lett.,**73**,26,3532 (1994))

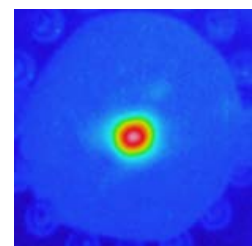


Multi-Frequency Gyrotron

Secondary, He demonstrated experimentally 1MW/170GHz power generation with the CW-compatible high order oscillation mode, which is mandatory for high field tokamak plasma such as ITER. (K. Sakamoto, et al., Nucl. Fusion **43**, 729(2003) & **49**,095019(2009))

Thirdly, the bottle neck of the MW-CW gyrotron was output window. He enabled the demonstration of MW-long pulse operation using the diamond output window. Before the diamond, the temperature increase of the window was so drastic to be impossible MW-CW operation. The edge cooled diamond window was developed with an EU-JA collaboration led by him, and the diamond window was installed to the 170GHz gyrotron. As a result, the stabilization of the window temperature was demonstrated, and opened the way toward the 1MW/CW operation. After the success, the ECH system was employed on the JT-60U, and electron temperature of 300M Kelvin was obtained using 110GHz gyrotrons with the diamond window.

Fourthly, the achievement of 1MW class CW gyrotron. The major obstacle of the gyrotron oscillation at high order mode is the mode competition. By active control of the electron beam parameters during the oscillation, 1MW CW operation was achieved with an unprecedented efficiency of 55% in the so-called hard excitation region. It was found that an adjacent resonant mode previously expected to compete with and adversely affect the principal operating mode does not jeopardize but rather helps this mode as a result of nonlinear effects. Also, 0.8MW 1hour operation was demonstrated at 57 % efficiency. (K.Sakamoto, et al., Nature Phys.**3**, p.411 (2007))



Power Profile of 236GHz wave at the window

The fifthly, He developed multi-frequency gyrotron by finding the best array of oscillation modes, and beautiful microwave beams were obtained at each frequencies, i.e, 104GHz, 137GHz, 170GHz, 203GHz and 236GHz. By changing the magnetic field and the applying voltage, users can select the frequency. Picture is a multi-frequency gyrotron, and the profile of 236GHz mm-wave beam measured at the output window.

Press Release

Appendix: 2025 AAPPS-DPP Plasma Innovation Prize



AAPPS-DPP Plasma Innovation Prize was founded by the AAPPS-DPP in 2019. This prize is given to a plasma physicist/engineer annually to recognize outstanding contributions to experimental and/or theoretical research in all fields of plasma applications, focusing on impacts on industry. The prize recipients were Professor Roderick Boswell (2019), Masaru Hori (2020), Dr. Anthony B Murphy (2021), no winner (2022), Takayuki Watanabe (2023), Miran Mozetic(2024). The 2025 Selection Committee composed of leading physicists of plasma application mostly in Asia Pacific region.

Selection committee:

Chairman: Prof. Se Young Moon (Jeonbuk National University)

Members:

Prof Nor Aishah Saidina Amin (University of Technology Malaysia)

Prof Minsup Hur (Ulsan National Institute of Science and Technology(UNIST))

Prof Ke Lan (Institute of Applied Physics and Computational Mathematics(IAPCM))

Prof Guosheng Xu (Institute of Plasma Physics, CAS)

Prof Alphonsa Joseph (Institute for Plasma Research)

Prof. D.N. Gupta (University of Delhi)

Prof Tsun-Hsu Chang (National Tsinghua University)

Prof Ana Sobota (Eindhoven University of Technology)

Prof Toshiro Kaneko (Tohoku University)

Prof Kazunori Takahashi (Tohoku University)



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Jeonbuk National University, Republic of Korea

Dear Prof. Mitsuru Kikuchi

It is my great honor in conveying the decision of the Selection Committee of the AAPPS-DPP Plasma Innovation Prize (PIP) 2025. The Selection Committee recommends that the AAPPS-DPP PIP for the year of 2025 be awarded to Dr. Keishi Sakamoto from Kyotofusioneering, Ltd.

The proposed award citation for the awardee is as follows:

Dr. Keishi Sakamoto: For his outstanding contributions to the development and commercialization of gyrotron and mm-wave facilities and demonstration for 1 MW gyrotron oscillation, electron spent beam energy recovery and diamond output window for delivering high-efficiency power of megawatt-class gyrotrons, that have helped elucidate fusion plasma devices; for commercialization of gyrotron for plasma heating and demonstration for a practical energy source, fusion energy.

The committee reviewed the evaluation scores and comments carefully and had a discussion regarding the selection of awardee. The awardee was unanimously approved by committee members who submitted their evaluations through e-mail (11 out of 12 committee members participated in the discussion)

Committee members for Plasma Innovation Prize 2025

Prof. Se Youn Moon (Chair), Prof. Ana Sobota, Prof. Ke Lan, Prof. Toshiro Kaneko, Prof. Guosheng Xu, Prof. Alphonsa Joseph, Prof. D N Gupta, Prof. Tsun-Hsu Chang, Prof. Minsup Hur, Prof. Kazunori Takahashi, Prof. Nor Aishah Saidina Amin

Your sincerely

Professor Se Youn Moon

Chair, Selection Committee of AAPPS-DPP Plasma Innovation Prize 2025