CES–CHEM MEETING 2024

PROGRAM BOOK

November 5-6

Kyoto University, Katsura Campus

Contents

Welcoming Message from JICA Advisor at AUN/SEED-Net

First and foremost, I would like to express my sincere appreciation to Kyoto University for inviting AUN/SEED-Net to participate in this important event.

AUN/SEED-Net has been promoting academic collaboration in the field of engineering across ASEAN and Japan for the past 20 years. The CES-CHEM consortium, which is jointly led by Kyoto University, Kyushu University, Tohoku University, and Burapha University in Thailand, stands as an exemplary initiative that embodies this spirit of collaboration. I am particularly pleased that AUN/SEED-Net has been working closely with this consortium, where researchers from ASEAN and Japan are achieving meaningful outcomes in flow chemistry. Additionally, I am delighted to see that this event also includes a presenter from South Africa, showcasing the expanding global reach of this collaborative effort.

Moreover, I would like to express our deep appreciation for the effective utilization of the Sakura Science Program within the CES-CHEM initiative. This program has provided many students and young researchers with the opportunity to visit Japan and gain valuable experience in cutting-edge research environments. We hope that the support from AUN/SEED-Net for CES-CHEM, combined with the Sakura Science Program, will generate a strong synergistic effect, further strengthening ties between ASEAN countries and Japan.

I would also like to mention that I had the pleasure of participating in a CES-CHEM workshop hosted by Burapha University in Thailand last December. I was deeply impressed by the active presentations and exchanges of opinions from young faculty, researchers, students, and participants from the industrial sector. The energy and enthusiasm displayed at that event left a lasting impression on me, and it highlighted the importance of fostering interactions across various sectors.

I am confident that this CES-CHEM Workshop will foster new opportunities for research collaboration and produce even more significant results. AUN/SEED-Net remains committed to promoting research and educational cooperation between ASEAN and Japan in the engineering field.

Finally, I would like to once again extend my heartfelt thanks to Kyoto University and all those involved in organizing this workshop, as well as to our partners from Kyushu University, Tohoku University, and Burapha University for their leadership in this consortium. We look forward to continuing our cooperation with all of you in our shared pursuit of further progress.

Thank you very much.

Hideki Shimazu
JICA Expert, AUN/SEED-Net Secretariat

Welcoming Message from CES-CHEM Consortium

We are pleased to welcome you to the CES-CHEM 2024 meeting! CES-CHEM has emerged as a vital consortium, connecting researchers from academic and industrial institutions across Thailand, Japan, Singapore, and South Africa. Our focus is on advancing the fields of chemical engineering, flow chemistry, and sustainable process development.

Over the past two years, we successfully held our inaugural CES-CHEM meeting in Bangsaen, Chonburi, and facilitated collaborations and exchanges among faculty, researchers, and students.

We extend our heartfelt gratitude to JICA AUN/SEED-Net for their generous support in establishing and operating the CES-CHEM consortium. Our thanks also go to the Subdivision of Micro Chemical Process Engineering and Digi-TOS Project for their collaboration in making this meeting possible. Special appreciation is due to Assistant Professor Yosuke Muranaka and Associate Professor Shusaku Asano for their efforts in organizing this informative event.

We invite you to engage fully in the CES-CHEM 2024 meeting in Kyoto, Japan. We hope that these two days will be productive and inspiring for everyone involved.

Dr. Charoen Chinwanitcharoen
Head of Chemical Engineering Department,
Burapha University, Thailand (Member Type A)

Associate Professor Dr. Nopphon Weeranoppanant
Department of Chemical Engineering,
Burapha University, Thailand (Member Type A)

CES-CHEM

Consortium of continuous process enabling sustainable chemistry or CES-CHEM is an academic and research consortium with objectives to promote research and technology development related to flow chemistry and continuous manufacturing. The consortium was found in 2023 with an initiative support from the ASEAN University Network/Southeast Asia Engineering Education Development Network (AUN/SEED-Net).

As the field of flow chemistry and continuous manufacturing of chemicals have been growing considerably during the last decade, both academia and industries have begun to adopt and implement continuous-flow technologies into a wide range of chemical processes such as synthesis of pharmaceuticals, fine chemicals, and nanoparticles. The research work in this field is also becoming interdisciplinary by integrating multiple disciplines such as robotics, automation, and machine learning, to allow the continuous-flow processes to be conducted with minimal human intervention.

To respond to this rapid growth of the field, researchers in South East Asia, Japan, and South Africa, plans to organize a consortium with the aim of accelerating the research advancement in this field. To the best of our knowledge, this consortium will be the first in this region. The consortium members will consist of researchers and experts from both academia (Burapha University, Thailand; Kyushu University, Japan; Kyoto University, Japan; National University of Singapore, Singapore; Nelson Mandela University, South Africa) and partners (AIST, Japan; Hitachi, Japan; EYELA, Japan; iFactory, Japan). Through such strong partnerships with private sectors and industries, the consortium will develop technologies in alignment with the industry's needs.

AUN/SEED-Net

JICA

SMCPE, SCEJ／化学工学会 反応工学部会 マイクロ化学プロセス分科会

The Subdivision of Micro Chemical Process Engineering (SMCPE) promotes communication between academics and industrial engineers working in flow chemistry and microreaction technology. As part of the Division of Chemical Reaction Engineering within the Society of Chemical Engineers, Japan (SCEJ), SMCPE organizes a symposium at SCEJ's autumn meeting and hosts seminars and networking events for both industrial researchers and academic professionals.

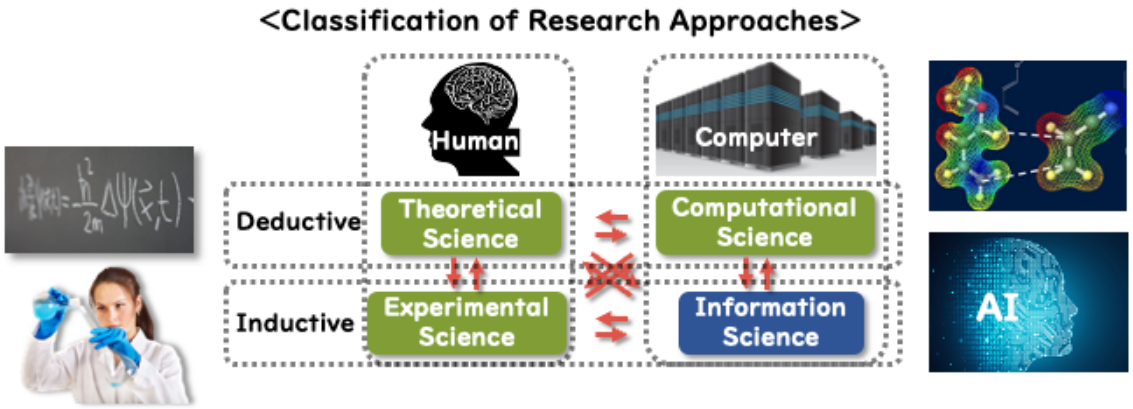
SMCPE

Digi-TOS Project／学術領域変革研究（A）“デジタル有機合成”

A new academic revolution research area called “Digitalization-driven Transformative Organic Synthesis (Digi-TOS)” was launched in September 2021 with the aim of achieving disruptive innovation in organic synthesis through the fusion of the disparate fields of organic synthesis (experimental science) and data science (information science).

This research field will revolutionize organic synthesis, accompanied by a mindset shift, through the construction of a unique digital platform (PF) that can cope with the diversity of organic synthesis. This research field maximizes the benefits of group research and is distinct from conventional AI research. Specifically, it will eliminate waste through automated methods (molecular structure automatic design, synthetic route automatic search, reaction condition automatic optimization, batch-to-flow automatic conversion, and autonomous automatic synthesis system) that thoroughly utilize artificial intelligence (AI), as well as build its unique database (DB) optimized for machine learning in organic chemistry, which forms the foundation for the development of automated methods. With the promotion of this research field, we aim to achieve ultra-acceleration of innovative reactions and the creation of innovative molecules, leading to the exploration of uncharted territories in the future.

For more information, please visit https://en.digi-tos.jp.



デジタル有機合成
Digitalization-driven
Transformative Organic Synthesis (**Digi-TOS**)

Detailed Program: Day 1, November 5th, 2024

"Emerging technology and new concepts in flow chemistry"

Main venue: A2-306, Kyoto University, Katsura Campus

Start time	End time	Agenda
9:00	9:30	Registration opens
Opening Session Chair: Dr. Yosuke Muranaka		
9:30	9:45	Welcoming remarks Prof. Katsuaki Tanabe, Head of Undergraduate Course Program of Chemical Process Engineering Prof. Masahiro Oshima, Vice president of Kyoto University Mr. Hideki Shimazu, JICA Advisor, AUN/SEED-Net
9:45	9:55	Brief Introduction of AUN/SEED-Net by Dr. Sirin Chakamanont
9:55	10:05	CES-CHEM activity reports by Dr. Nopphon Weeranoppanant
Chair: Dr. Koichiro Masuda		
10:05	10:55	**Plenary lecture:** ***Flexible Automated System for Flow Reaction Experiments*** **Prof. Ken-Ichiro Sotowa, Kyoto University**
Chair: Dr. Nopphon Weeranoppanant		
10:55	11:25	*Science for Society: The impact of research on education and industry* Prof. Paul Watts, Nelson Mandela University, South Africa
11:25	11:55	*What is the role of academic research for creating new industries?* Dr. Kosuke Hiromori, Tohoku University/Phytochem Products, Japan
Photo Session		
12:00	13:00	Poster Session*
Lunch Break		
14:00	17:45	Parallel workshops: 1. *Remote and automated flow chemistry devices using Raspberry Pi** (Provided by Sotowa Lab, Kyoto University) 2. *Life cycle assessment using open-source software** (Provided by Nop Lab, Burapha University & VISTEC) 3. *Chemical reaction engineering for organic chemists* (Provided by Dr. Shusaku Asano, Kyushu University)
18:30	20:30	Networking session*

On-site only

Detailed Program: Day 2, November 6th, 2024

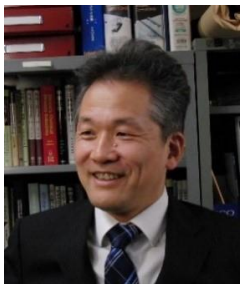
Main venue: A2-306

Start time	End time	Agenda
Session Chair: Dr. Shusaku Asano		
9:00	9:50	**Plenary lecture hosted by Digi-TOS:** ***Towards On-Demand Synthesis of Organic Small Molecules*** **Prof. Jie Wu, National University of Singapore**
9:50	10:20	*Development of 'all-in-one' diagnostic kit for infectious diseases, integrating DNA amplification reaction space and lateral flow DNA-chromatography systems* Dr. Hiroyuki Miyamura, AIST, Japan
Break		
Session Chair: Dr. Kosuke Hiromori		
10:40	11:10	*Continuous "Manufacturing" of Fine Chemicals: a collaborative work by AIST and iFactory* Dr. Koichiro Masuda, AIST, Japan
11:10	11:25	*Sakura-Science Program Activity Summary* Dr. Yosuke Muranaka, Kyoto University, Japan
11:25	11:55	Panel discussion
11:55	12:00	Closing remark Dr. Charoen Chinwanitcharoen, Burapha University, Thailand

Plenary Speaker Abstract

Ken-Ichiro Sotowa

Kyoto University, Kyoto, 615-8510, Japan, sotowa@cheme.kyoto-u.ac.jp



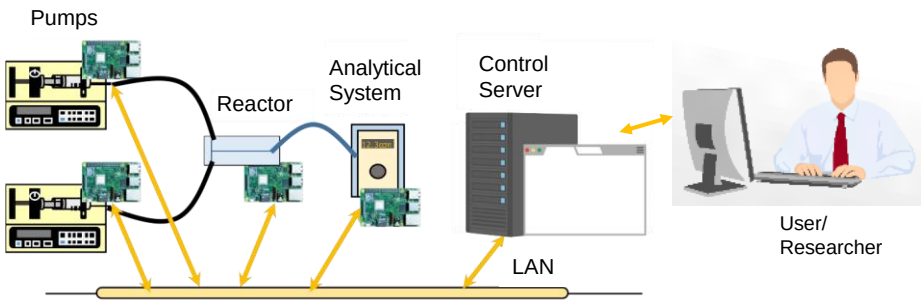
Sotowa began his studies in chemical engineering at Hiroshima University before moving to the University of Leeds, where he pursued his M.Sc.(Eng.) and Ph.D. studies under the supervision of Prof. Colin McGreavy. After joining Kyoto University as a postdoctoral research staff member, he contributed to various projects, including the optimization of crystallization processes. In 2000, Sotowa began researching microreaction technologies as an academic staff member at Kyushu University. He continued this work at Tokushima University, focusing on numerical simulations of segmented flow and developing a reaction device for unsteady state operations. Since 2019, he has been at Kyoto University, with recent interests in continuous flow processes and the automation of laboratory experiments for flow reactions. Sotowa has held leadership positions, including Head of the Subdivision of Micro Chemical Processes Engineering in the Society of Chemical Engineers, Japan (2014–2016), and the Editor-in-Chief of Journal of Chemical Engineering of Japan (2021–2023).

Flexible Automated System for Flow Reaction Experiments

Although many automated experimental systems have been reported in the literature, their adoption remains limited due to high costs and their applicability to only a narrow range of experiments. This study seeks to overcome these barriers by developing a flexible and cost-effective experimental system. To reduce costs, we built the system using standard laboratory equipment, each of which was transformed into an IoT module by adding a small computing device. These modules communicated via the internet, while a central control server managed the sequence of operations and issued commands during the experiment.

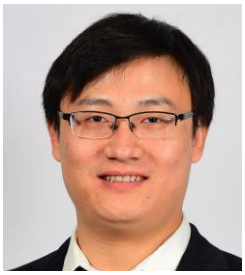
We evaluated the system's performance using the TEMPO oxidation of benzyl alcohol. IoT modules were created for syringe pumps, fraction collectors, and water baths. The system could be set up in less than a day, and its modular design allowed for quick reconfiguration to accommodate various reactions.

Keywords: Automation, Flow reaction, TEMPO oxidation



Jie Wu

National University of Singapore, 3 Science Drive 3, Singapore, 117543, chmjie@nus.edu.sg

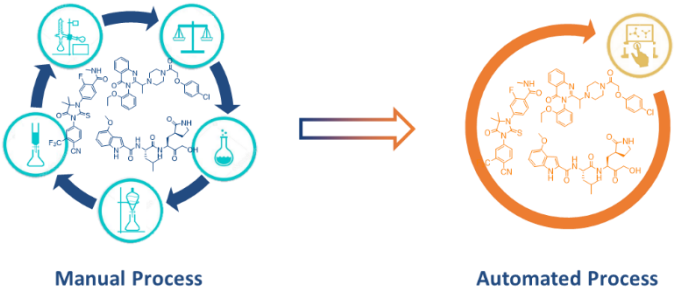


Jie pursued his PhD study with Prof. James S. Panek at Boston University working on natural product total synthesis. In his postdoc research at MIT with Prof. Timothy Jamison and Prof. Alan Hatton, Jie has been exposed to the hard core of continuous flow chemistry. Since joining NUS in July 2015, his research group focuses on new synthetic methodology development using photocatalysis assisted by advanced flow technologies. His group is also interested in the development of advanced flow technologies for on-demand and automated synthesis of functionalized organic molecules. In July 2021, Jie was promoted to tenured associate professor. Jie is a recipient of Dean's Chair Professor (2023), Tokyo Chemical Industry-SNIC Industry Award in Synthetic Chemistry (2021), NUS Young Research Award (2021), Yong Scientist Award (2020), Asian Core Program Lectureship Award (2017-2022), Thieme Chemistry Journal Award (2019), and NUS Chemistry Department Young Chemist Award (2018).

Towards On-Demand Synthesis of Organic Small Molecules

"Button-push" automated synthesis of complex molecules represents one of the future goals for organic synthesis. In this talk, I will present some of our recent efforts towards this goal employing advanced flow reactors. A "stop-flow" micro-tubing (SFMT) reactor platform was invented,[1] which is especially suitable for gas involved reactions under light irradiations.[2] Continuous flow reactors were applied to achieve stepwise on-demand functionalization of multihydrosilanes using neutral eosin Y-based hydrogen atom transfer photocatalysis.[3] An SPS-flow system was employed to enable automated API synthesis that can deliver analogues in an on demand and button-push fashion.[4]

Keywords: Flow chemistry, Automation synthesis, Drug discovery



References:

[1] F. Xue, H. Deng, C. Xue, D. K. B. Mohamed, K. Y. Tang, J. Wu, *Chem. Sci.* **2017**, **8**, 3623.
[2] H. Deng, Q. Zhou, J. Wu, *Angew. Chem. Int. Ed.* **2018**, **57**, 12661.
[3] Fan, X.; Zhang, M.; Gao, Y.; Zhou, Q.; Zhang, Y.; Yu, J.; Xu, W.; Yan, J.; Liu, H.; Lei, Z.; Ter, Y. C.; Chanmungkalakul, S.; Lum, Y.; Liu, X.; Cui, G.; Wu, J. Nat. Chem. **2023**, **15**,666-676.
[4] C. Liu, J. Xie, W. Wu, M. Wang, W. Chen, S. B. Idres, J. Rong, L.-W. Deng, S. A. Khan, J. Wu, *Nat. Chem*. **2021**, **13**, 451.

Poster Presentations

Lobby in front of the A2-306, Posting time: 9:30-14:00, Nov. 5th

#	Presenter	Affiliation	Presentation Title
01	Takanari KOIKE	Kyoto U.	Elucidating the correlation between degradation rate and highly ordered structure in biodegradable plastics
02	Kyoka HINOMOTO	Okayama U.	Continuous Preparation of Core-Shell Polymer Particles Using W/O Slug Flow
03	Kokhao CHITNIRATNA	VISTEC	Development of Solvent Extraction: from Solvent Modeling to Automated Process Optimization
04	Yukako ASANO	Hitachi, Ltd.	Study on channel methods in microreactors for mixing at a high flow rate ratio
05	Shotaro DANJO	Kyoto U.	Room-temperature aqueous synthesis of bulk-immiscible Pd-Ru alloy nanoparticles enabled by microreactor
06	Athippracha WATTANAWIJIT	Burapha U.	Development and scale up of dynamic-flow extraction
07	Tsinjo Nirina RAFENOMANANANJARA	Kyushu U.	Phytic acid as a bio-renewable catalyst for cellulose conversion to levuglucosenone
08	Waichaya SIRIMONGKHOL	Burapha U.	Understanding the effect of reactor-to-particle diameter ratio on photocatalytic packed bed reactor performance
09	Tomoyasu KUBO	Tohoku U.	Controlling water partition for designing continuous esterification process without reverse reaction
10	Sirichai BOONWATANANUSORN	VISTEC	Process characterization of lipase-catalyzed reaction systems
11	Gakuto ONISHI	Kyushu U.	Dopamine-based immobilization of lipase for flow reactors
12	Taiki OKUDA	Tohoku U.	Clarification of adsorption mechanism in one-step flow type purification process for organic modified nanoparticles
13	Sippakorn MAPINTA	VISTEC	Continuous-Flow Chemo-Enzymatic Gram-Scale Synthesis of Indole-3-Acetic Acid

Parallel Workshops

	#1 Remote and automated flow chemistry devices using Raspberry Pi	#2 Life cycle assessment using open-source software (OpenLCA)	#3 Chemical reaction engineering for organic chemists
Lecturer	Mr. Koki Nagasawa Kyoto University	Mr. Panitan Thakhiew, Burapha University	Dr. Shusaku Asano Kyushu University
Requirement	None	Laptop PC, installation of the Open LCA	None
Venue	Intech center 105	A2-216, on-site only	A2-306, ZOOM

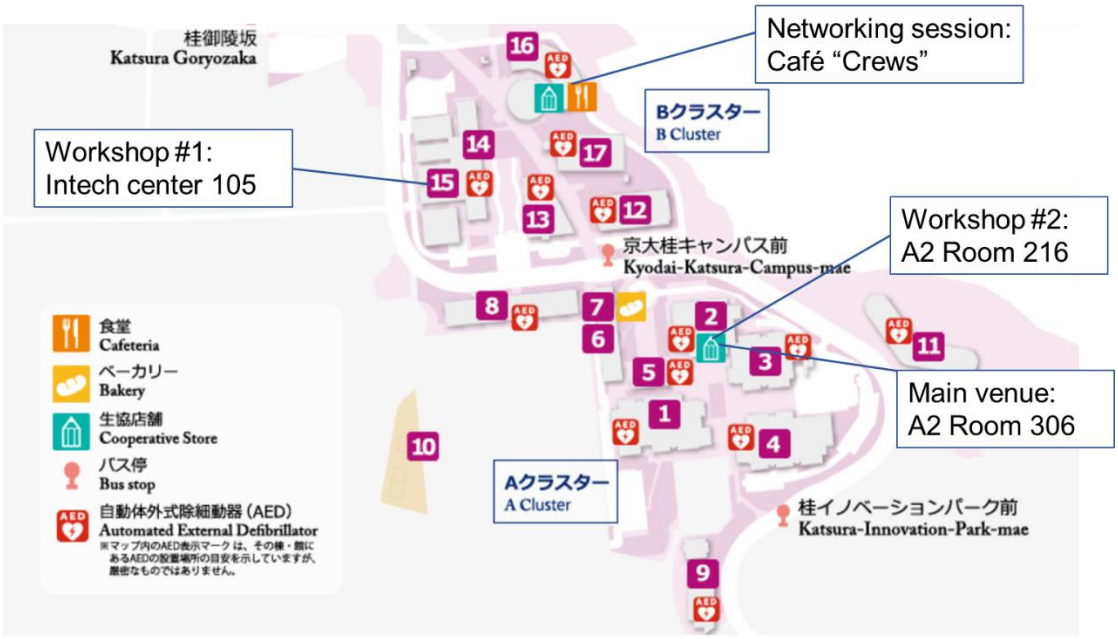
Brief descriptions:

#1. An automated experimental system has been developed at Kyoto University. The concept and operation procedure of the system will be explained in this workshop. Participants will also have the opportunity to experience the operation of a flow experiment setup using the system.

#2. The workshop will include the introduction and the importance of life cycle assessment and the example of the life cycle assessment of the chemical process. The attendee will be able to perform a life cycle assessment of the example process using open-source software (OpenLCA) to evaluate the environmental impact of the process. The workshop can be performed without an internet connection. Attendees must bring their own laptop PC. The OpenLCA software installation files, the database, and the workshop instruction will ready to download after 15 October 2024 from https://shorturl.asia/Lfmbh

#3. Chemical reaction engineering is a discipline to design and operate an ideal reactor to maximize the throughput while minimizing a side product. The essence and practical tips for flow chemistry will be introduced without complicated equations. Mixing time estimation, temperature control strategy, and residence time distribution will be featured.

Venue Arrangement



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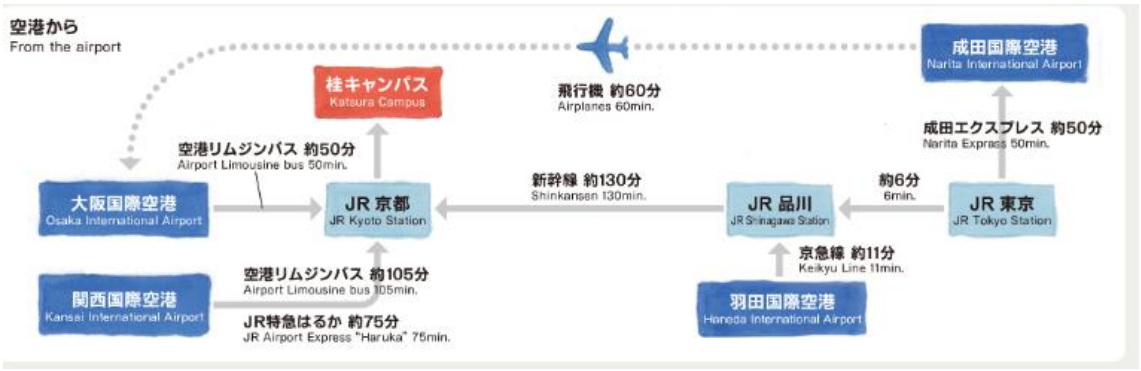

From Kyoto City:

[Katsura Campus Map | KYOTO UNIVERSITY (kyoto-u.ac.jp)]

Railway station	Boarding bus stop	Bus route	Travel time	Arrival bus stop
Hankyu Railway Katsura Station	Katsura Statation (Nishiguchi)	Kyoto City Bus Nishi 6 (Katsurazaka-chuo)	About 12 minutes	Katsura Innovation Park-mae, Kyodai Katsura Campus-mae (Kyoto Univ. K), or Katsura Goryozaka
	Katsura Station (Nishiguchi)	Keihan Kyoto Kotsu Bus 20 and 20B (Katsurazaka-chuo)	About 12 minutes	Katsura Innovation Park-mae, Kyodai Katsura Campus-mae (Kyoto Univ. K), or Katsura Goryozaka
	Taxi		About 8 minutes (fare: about 1,200 yen)	

JR/Kintetsu Railway Kyoto Municipal Subway Tozai Line Kyoto Station	Kyoto Station	Keihan Kyoto Kotsu 21 and 21A (Katsurazaka-chuo)	About 45 minutes	Katsura Innovation Park-mae, Kyodai Katsura Campus-mae (Kyoto Univ. K), or Katsura Goryozaka
	Taxi		About 35 minutes (fare: about 4,000 yen)	

Wi-fi

Public Wi-fi available in Kyoto University is eduroam.

What is eduroam? - eduroam.org

eduroam (education roaming) is the secure, world-wide roaming access service developed for the international research and education community.

eduroam allows students, researchers and staff **from participating institutions** to obtain Internet connectivity across campus and **when visiting other participating institutions** by simply opening their laptop.

Please check the availability and access procedure from **your institution**.

ZOOM Information

On-line attendees can access the meeting via following link or ID.

https://us02web.zoom.us/j/83694596629?pwd=bbPZhRtHQeZda498FTLwLVxf1F38fH.1

Zoom Meeting ID: 836 9459 6629

Passcode: 332364

Organizers

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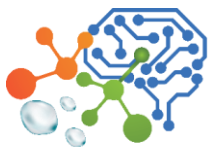

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