The University of Electro-Communications

UEC Research and Innovation

Latest updates on research and innovation at UEC Tokyo.

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News

Building Bridges for Future Partnerships: UEC President Shunichi Tano and Director Kazuaki Oya Cultivate Collaborations in New Zealand

In a significant stride towards global academic collaboration, President Shunichi Tano and Member of the Board of Directors Kazuaki Oya of UEC visited New Zealand from December 4 to 8. The delegation, accompanied by key university representatives, visited the three major cities of Auckland, Wellington, and Christchurch.

One of the highlights of their visit was the inaugural UoA・UEC Trans-Pacific Symposium on Advanced Science and Engineering 2023, held in collaboration with the University of Auckland. The symposium, conducted in a hybrid format on December 4th, featured presentations from both institutions. Notable among them was Professor Yasuhiro Minami's insightful talk on "A new perspective on vocabulary spurt: A longitudinal data analysis of early vocabulary development in Japanese infants." Dr. Patrice Delmas from the University of Auckland shared ongoing research at the IVSLab, sparking dynamic discussions. Plans are in place to expand participation and continue the symposium in the years to come.

The collaborative spirit extended beyond the symposium, with visits to institutions including Auckland University of Technology, Victoria University of Wellington, and the University of Canterbury. Discussions centered on the potential for future collaboration, including international exchange agreements. Positive responses were received, indicating a promising future for academic partnerships.

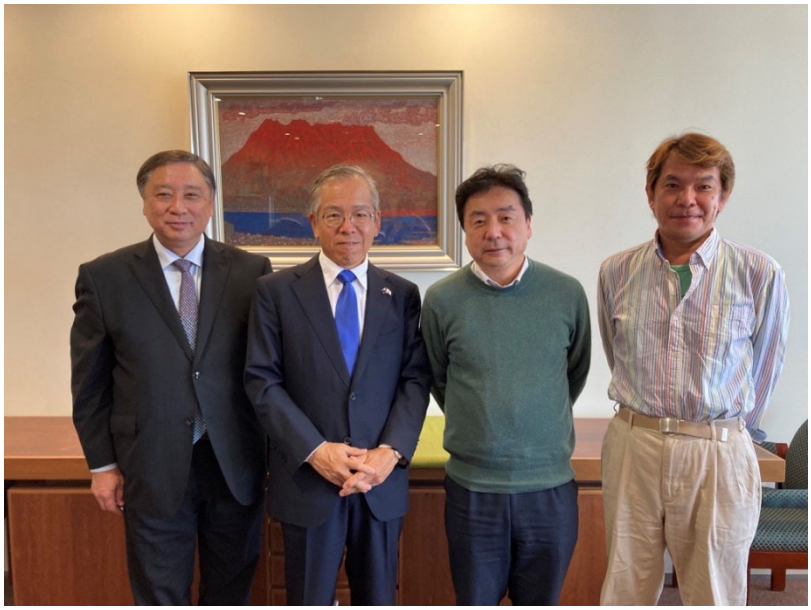
Not limiting their engagements to academia, the delegation also explored opportunities with private enterprises. Visits to companies like Allied Telesis Ltd. and Volpara Health led to discussions on hosting UEC students for internships and collaborating on research projects.

Diplomatic efforts were not overlooked, as the delegation visited the Japanese Embassy and Consulate General in each city. Here, they outlined the vision of UEC, seeking understanding and cooperation for fostering collaboration between UEC and New Zealand.

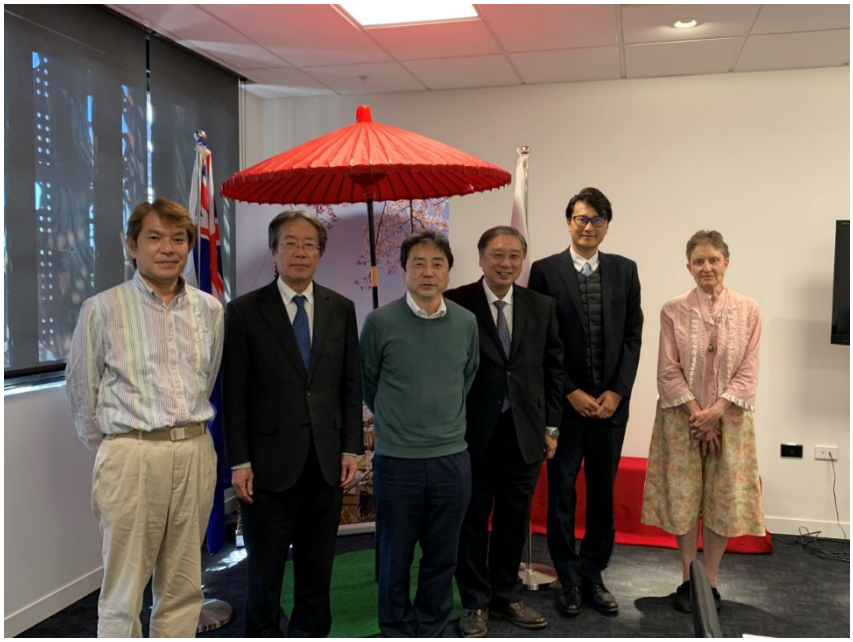
This visit serves as a catalyst for future initiatives, and UEC is committed to further enhancing its collaboration with New Zealand in the areas of academia, industry, and diplomatic relations. UEC will continue to share updates about this exciting global partnership.

Attendees at the UoA・UEC Trans-Pacific Symposium on Advanced Science and Engineering 2023.

Consul General of Japan in Auckland Matsui and President Tano.



Visit to the Japanese Embassy in New Zealand



Visit to the Japanese Consular Office in Christchurch

Video Profile：Research

Condensed matter physics: Materials science at ultra-high 1000 T magnetic fields

Akihiko Ikeda
Assistant Professor, Department of Engineering Science

Akihiko Ikeda introduces his research on condensed matter physics, particularly the effects of high magnetic fields up to 1000 Tesla on materials. Under these extreme magnetic conditions, changes occur not only in electron spin but also in the electronic, phononic, optical, and lattice states. Ikeda's primary goal is to observe material phase transitions leading to entirely new crystal structures unique to very high magnetic fields.

The realm of very high magnetic fields remains largely unexplored due to experimental and theoretical challenges. Ikeda describes an experimental technique known as a destructive pulse magnet, utilizing electromagnetic flux compression. The process involves compressing the electromagnetic field to achieve magnetic fields ranging from a few hundred to a thousand Tesla. However, after field generation, the coil is consistently damaged, illustrating the difficulties in this pioneering work.

To delve into such exotic high magnetic fields, new techniques for material science need development. Ikeda describes his development of a strain gauge using an optical fiber called fiber Bragg grating, enabling magnetostriction measurements up to a thousand Tesla. "This technique revealed a new phase of matter in the perovskite-structured cobaltite $LaCoO_3$," says Ikeda. "We expect to uncover more material properties in the 1000 Tesla region."

At the University of Electro-Communications (UEC), Ikeda has created a portable 100 Tesla generator named PINK to explore the microscopic properties of materials at such high magnetic fields. The experimental process involves exploding the coil, generating 77 Tesla at SACLA, the x-ray free electron laser (XFEL) facility in Japan. The XFEL pulse is synchronized with the highest magnetic field generation, enabling X-ray diffraction measurements at 77 Tesla. The second generation of PINK is currently under development, aiming to conduct X-ray measurements above 100 Tesla in the near future.

"The exploration of 1000 Tesla magnetic fields extends beyond material science, encompassing a broader range of scientific disciplines such as molecular science, biology, plasma physics, and fundamental sciences like particle physics," explains Ikeda. "I welcome newcomers and encourage further collaborations both within and outside the UEC, on this entirely new frontier of science."

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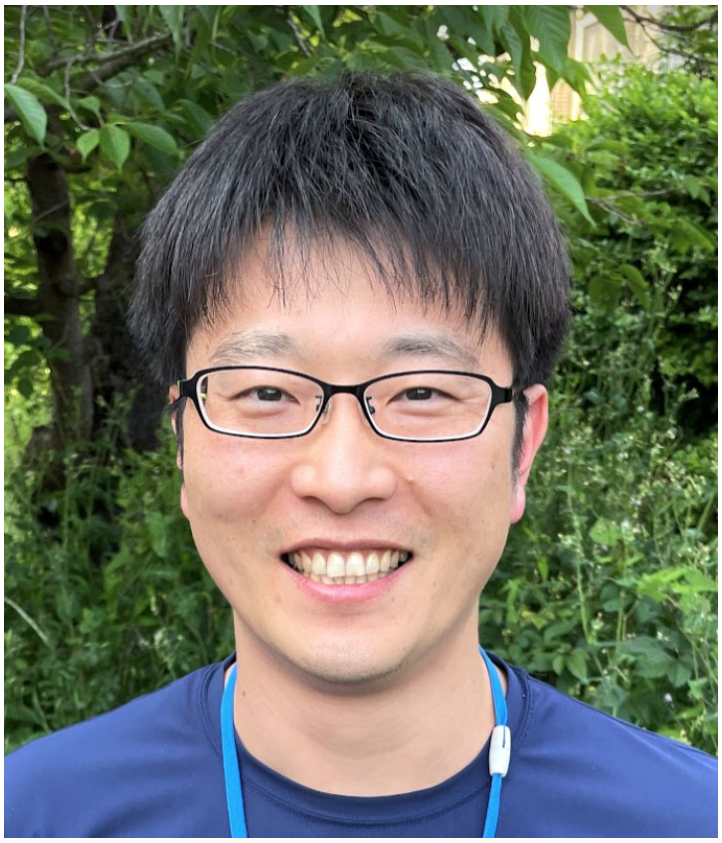

Video Profile：Innovation

AINet: AI for Innovative Wireless Networking

Katsuya Suto
Associate Professor, Graduate School of Infomatics and Engineering

Associate Professor Katsuya Suto and his group is dedicated to revolutionizing wireless communications and networking through the integration of AI technologies.

Suto is focused on the integration of joint source and channel coding using deep neural networks. In current wireless communication systems like 4G and 5G, source coding caters to user services, but communication quality suffers due to non-optimized channel coding, leading to issues like block noise in video transmissions.

In contrast, the communication system being developed by Suto tailors both source and channel coding for user services, mitigating block noise in video transmissions. “We believe this system holds potential for future applications, such as object detection for autonomous vehicles,” says Suto.

The impact of this new communication system can be seen in remote object detection. Despite a slight decrease in image quality compared to the original, Suto’s system maintains sufficient accuracy for object detection.

Another application of Suto’s communication system is integration with Google Maps. In the video, the mobile terminal estimates the radio map of user mobility from Google Maps, training the communication system accordingly. This ensures quality of service even in challenging wireless environments, offering stable video transmission during 5G outages.

In another application, Suto is addressing the high cost of radio map construction, by developing a low-cost solution using AI. By utilizing a 3D city model from open datasets like PLATEAU, Suto’s approach significantly reduces costs. Furthermore, the new system analyzes the radio path propagation process by the construction of a radio propagation graph. Implemented with shallow feedforward neural networks, this approach achieves twenty times faster computation than traditional ray tracing.

“Feel free to reach out for more information about our activities.”

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