

No.

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NCU NEWSLETTER

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Scientists Sailed Deep into the Polar Circles**

- NCU in Collaboration with Ways Technical Corporation Set a New World Record of Power Conversion Efficiency
- NCU Made a Splash in the 2021 Future Tech Awards
- 2021 NCU Photo Contest for Ten Campus Scenes: Discover the Beauty of NCU



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Boldly Exploring the Edge of the World: NCU Scientists Sailed Deep into the Polar Circles

▲ For the first time, the College of Earth Sciences at NCU invited two scientists, who respectively went to a polar circle to conduct research, to give a speech at the weekly meeting of the College.

Photo by Lai Lu-Yun

How would penguins in the Antarctic meet polar bears in the Arctic? The College of Earth Sciences at NCU gathered two speakers to give speeches at the college's weekly meeting. The speakers were Assistant Professor Cissi Ying-tsen Lin at the Department of Space Science and Engineering, the first Taiwanese female scientist that conducted research, winter-overed, and stayed consecutive 54 weeks in the Antarctic, and Professor Hao Kuo-Chen at the Department of Earth Sciences, who led the first Taiwanese expedition team of earth sciences that set up our national flag in the Arctic. Through

their splendid and immersive sharing of experiences, the two speakers led the audience to the adventures of Taiwanese earth sciences teams into the polar circles.

The topic of Professor Lin's speech was "To the Bottom of the World." She shared with the audience how she had stayed in the harsh environment of the Antarctic for 54 weeks. The journey to and the life in the Antarctic as well as the trip coming back to Taiwan were unpredictable. Even though the Antarctic is called "the last virus-free continent," life at the Antarctic research station was full of uncertainties while the pandemic

of COVID-19 was wreaking havoc around the world.

Professor Lin said that material supplies are lacking and the convenience of modern life is absent in the Antarctic; living there is like living in outer space. Furthermore, there are also polar days and polar nights, which are an ordeal to one's spirit. However, recalling the days at the Antarctic research station, Professor Lin had also recorded 1,600 hours of firsthand data collected by three sets of lidar after having had endured epic blizzards. Having brought the valuable experiences back to Taiwan is Professor Lin's greatest comfort.

Professor Kuo-Chen told the audience that it was not difficult to travel to the Arctic Circle before the pandemic; however, making decisions in an unpredictable environment when faced with the uncertainties during the ravaging pandemic was the most difficult. With the topic of "Accepting Challenges,"

Professor Kuo-Chen depicted why and how the Arctic expedition team was established, the experiences of the team members, their mental preparation and short stories before and after the journey to the Arctic Circle, and the change in their lives after the journey.

Svalbard, an archipelago in the Arctic Circle, is unknown to most people. However, it is a very important place of exploration for scientists. In this journey, the three members of Professor Kuo-Chen's team applied the methods of geological survey, landform survey, and geophysical survey and brought first-hand observation data back to Taiwan. The team has paved the way for the further development of Taiwan's research on the Arctic Circle. Professor Kuo-Chen wishes that more partners could join them in the future. Moreover, he also expects to advance interdisciplinary research and expand international collaboration.



◀ Professor Cissi Ying-tsen Lin at the Dept. of Space Science and Engineering (left) and Professor Hao Kuo-Chen at the Department of Earth Sciences (right) shared their scientific research and lives in one of the polar circles, respectively.

Photo by Lai Lu-Yun

- ▶ Two groups of scientists respectively went deep into one of the two polar circles to conduct research. Both groups coincidentally set up the national flag of the Republic of China (Taiwan) on the lands of the Arctic and the Antarctic, respectively.

Photo courtesy: Prof. Hao Kuo-Chen and Prof. Cissi Ying-tsen Lin





NCU Initiates Partnership to Participate in International Moon Mission in Giant Leap for Taiwan Space Science

▲ NCU signs a MOU with HelioX Cosmos via teleconference to initiate participation in an international Moon mission, while working with the Japanese SpaceBD company to support the growth of Taiwan's space industry. Photo by Chen, Ju-Chih

Building on experience gained from the successful delivery and launch of the IDEASSat spacecraft by National Central University (NCU) in January, NCU President Jing-Yang Jou and CEO Huai-Chien Chang of HelioX Cosmos Company signed a Memorandum of Understanding via teleconference recently, establishing a partnership for Taiwan's first mission to deep space and the Moon. NCU will design and deliver a payload for inclusion aboard an international non-government Moon mission that will qualify NCU's satellite avionics for deep space use, while also providing measurements of the deep space radiation environment.

HelioX Cosmos is the exclusive agent for the Japanese SpaceBD Company, which is the designated service provider

for the Japan Aerospace Exploration Agency (JAXA). The three parties will work together to build an international academia-industry partnership to support public space science education, as well as to provide R&D, testing, and flight qualification services to Taiwanese firms interested in entering the space market.

President Jou stressed that NCU is home to the one and only Space Science and Engineering Department in Taiwan, with dedicated space related research centers including CAPE and the Center for Space and Remote Sensing Research (CSRSR). NCU is also one of the few institutions in Taiwan that has developed and flown satellite payloads and small spacecraft. NCU will work to cultivate a new generation of space professionals for Taiwan, while also working with public and private entities to support the development of the space industry in Taiwan.

NCU in Collaboration with Ways Technical Corporation Set a New World Record of Power Conversion Efficiency

The organic photovoltaics (OPV) mini-module co-developed by the Research Center of New Generation Light Driven Photovoltaic Modules (RCNPV) at National Central University (NCU) and Ways Technical Corp., Ltd./Nanobit Tech. had just set a new world record efficiency of 13.6%! The outstanding research outcome was published in *Progress in Photovoltaics: Research and Applications*, an authoritative international journal in the field of solar cell technology. It was also the first joint research team in Taiwan that have been listed in the Solar Cell Efficiency Tables section of this journal.

“OPV technology has numerous advantages, including semi-transparence, color variability, flexibility, simple fabrication process, low manufacturing costs, short energy payback time and excellent power conversion efficiency under the dim-light and indoors lighting, which allows it to be applied in many aspects of our daily lives: electric power

to all types of IoT sensors, portable electric devices, and sustainable farms as well as using as building integrated photovoltaic (BIPV) electric generation systems, portable charging devices, and so on. Its commercial value is inestimable,” said Prof. Chun-Guey Wu, Director of the RCNPV.

The champion OPV mini-module was verified Photovoltaic Efficiency Verification Laboratory (PVEVL, accredited by ISO/IEC 17025) of RCNPV and finally confirmed by the European Commission Joint Research Centre—European Solar Test Installation (JRC-ESTI), an authoritative internationally recognized solar cell and module calibration and efficiency verification laboratory. The efficiency verification data of obtained by PVEVL were excellent matched with the data measured by the JRC-ESTI. The highly consistent results also suggest that NCU’s PVEVL can provide an accurate verification of the performance of emerging solar cells for academic and industry sectors in Taiwan in time.



▲ Photo of Prof. Wu and Prof. Chen in the Photovoltaic Efficiency Verification Laboratory at NCU. Photo by Chen Ju-Chih

PM 2.5 Monitoring Techniques Developed by NCU Was Published in *Environment International*

Dr. Lin Yuan-Chien, Associate Professor in the Department of Civil Engineering at NCU led his doctoral student Chi Wan-Ju and master's student Lin Yong-Qing to research the cross-disciplinary integration of the Internet of things (IoT) and spatiotemporal big data analytics for particulate matter 2.5 (PM2.5) concentration information with high spatiotemporal resolution. The research outcome was published in *Environment International*, one of the top SCI journals in environmental science.

Scientists have proved that long-term exposure to high-density PM2.5 will increase the risk of all kinds of diseases. Therefore, careful and precise PM2.5 monitoring bears great significance in the public's health and exposure assessment. This study provides strong scientific evidence for etiologic research on allergy, various types of respiratory and cardiovascular diseases, and even cancers. Furthermore, the research pioneers in interdisciplinary studies by integrating civil engineering and environmental studies, information technology applications, spatial informatics, and other research fields, demonstrating value in academic research and its practicality.

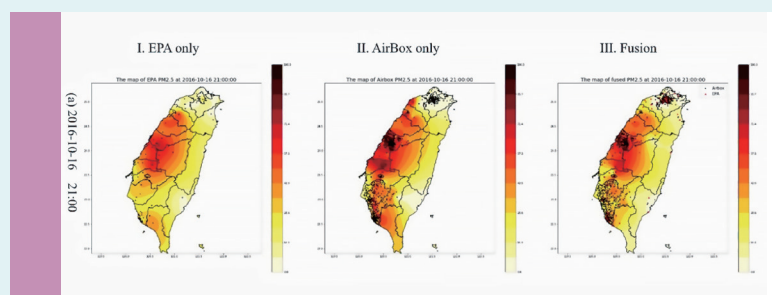
The research result showed that the data fusion techniques help estimate reasonably the PM2.5 concentration in



► A group photo of Dr. Lin Yuan-Chien and his research team in Hydrological and Environmental Informatics Laboratory in Dept. of Civil Engineering at NCU
Photo courtesy: Dept. of Civil Engineering

spatiotemporal distribution. Such techniques not only reduce the cost of air pollutant monitoring but also largely improve the efficiency of air-quality monitoring.

The research team led by Dr. Lin Yuan-Chien has outstanding research performance in hydrology- and environment-related issues and always wins recognition. Dr. Lin is also sponsored by the "Einstein Program," the Young Scholar Fellowship Program of the Ministry of Science and Technology (MOST). Currently, Dr. Lin's research team is eagerly undertaking several interdisciplinary collaborations with scholars in various fields, and the team will also continue to devote themselves to the academic and research development in hydrological and environmental issues.





AI-Based Brain-Computer Interface Research Team at NCU Set Foot in Future Learning



▲ The AI-based brain computer interface research team at NCU has developed a next-gen brainwave control device. In addition to medical treatment, the device can also be applied to future learning.
Photo by Cheng Pi-Hsien

How could we take a patient with amyotrophic lateral sclerosis (ALS), a confined soul, for a “video ride” by brain wave? A research team of AI-based brain-computer interfaces at NCU has broken through various limitations for recovering ALS patients’ autonomy and dignity. Furthermore, with the help of AI, the team has recently developed a next-gen tiny brainwave control device. In addition to medical treatment, the device can also be applied to future life and future education. With the brainwave control device, one can command a robot proxy for pandemic prevention and control. This innovation unfolds the future of “zero contact.”

Chair Professor Shyu Kuo-Kai and Professor Lee Po-Lei at the Department of Electrical Engineering have created the seventh-generation brainwave control device after more than a decade of research and development. They broke all limitations to reduce its size, simplify its circuits, and lower its fabrication cost. The device is about the size of a pack of cigarettes, and its appearance strikes a balance between a technological style and an aesthetic one. It passed the tests of

ISO10993 for biocompatibility and the tests of IEC60601 for general requirements for medical electrical equipment’s basic safety and essential performance. It is also a medical-grade device that can be applied to clinical treatment. The research team has initiated collaborations with each prominent medical institute to help patients with ALS, spinal cord injury, stroke, dementia, and melancholia.

In response to the need for pandemic prevention and control, the applications of brainwaves are also helpful in future learning. Assistant Professor Lee Lung-Hao, an expert in natural language processing, indicated that a teacher would know well of students’ cognitive and emotional information and understand whether the students are concentrating and whether they understand the content being taught as they put on the next-gen brainwave control device. With the device, the teacher could further analyze students’ reasoning ability and thus adjust their teaching methods to attain a win-win situation that benefits both teachers and students.

NCU Made a Splash in the 2021 Future Tech Awards

The list of winners of the 2021 Future Tech Awards was just released. Thirteen NCU research teams won the prizes, and another 13 technologies were nominated to the final list for demonstration. NCU took the stage at the 2021 FUTEX in the fields of space technology, atmospheric sciences, materials, biotechnology, cognitive neuroscience, mechanical engineering, and electrical engineering. The technologies developed by the NCU teams were gaining favors with the reviewers. NCU was one of the biggest winners in the 2021 Future Tech Awards, demonstrating NCU's strength in research development and innovation.

The 2021 FUTEX attracted more than 500 teams from industries, academia,

and research institutes to register. With a strict selection process, 100 technologies won the Future Tech Awards. The awards emphasized the “technological breakthroughs” and “industrial applications;” the prize-winning research outcomes were all cutting-edge and innovative technologies in contemporary academia and industries.

NCU is one of the top research-oriented comprehensive universities in Taiwan. In recent years, NCU Global Industry and Research Alliance (NCU GLORIA) has been eagerly encouraging faculty members as well as their research teams to register for various technological contests. Such an effort made NCU one of the biggest winners in the 2021 Future Tech Awards, and NCU also set a new record for the number of award-winning technologies. The public has witnessed and recognized the years of efforts and the research outcomes of NCU in the 2021 FUTEX.



▲ NCU took a leading role in the field of space science. The self-developed spacecraft avionics, space missions, and ground operation systems won the recognition of reviewers.



Fire Dance Art Club from NCU Awarded “Best Club Feature Award”

Flames burning in the dark fly about with arms on the field, leaving traces splendid and brilliant to our eyes. A total of 301 clubs participated in the 2021 National Evaluation of Clubs, and the Fire Dance Art Club from NCU was honorably awarded the “Best Club Feature Award.”

Club Leader Tang Wan-Shun said that behind the splendid performance was a great amount of hard work. In order to participate in this evaluation, the cadre members of the club dropped their personal affairs, carried the tools required for the fire dance, and travel a long way to Yunlin for shooting a video clip for the evaluation. They rearranged the order of moves in their dances, adopted new elements, and produced a new performance. They encountered many challenges in the processes of rehearsals, choosing venues for practice, and

▲ The Fire Dance Art Club from NCU was awarded the “Best Club Feature Award.” Photo courtesy: Fire Dance Art Club

scheduling. Eventually, they completed the filming after three days of incessant endeavor.

Although fire seems dangerous and intimidating, it is a sacred and awesome existence to Tang. Fire is actually pretty safe as long as a fire artist takes all the necessary protective measures. He pointed out that only when you come into contact with fire in person can you realize its safety and beauty. Facing the challenge of the pandemic that has made it difficult to pass on the experience and skills of old club members to new ones, he encouraged junior members that a fire artist can express the splendor of life through the fire dance as long as the artist handles safety with due care.



Cultivating Global Elites: The IMBA Program of the School of Management Starts Recruitment

The fully English-taught International Master of Business Administration (IMBA) Program of National Central University (NCU) will officially start the class in 2022. The IMBA program will recruit 11 local students and 10 international students for the first year. Students can enhance the professional knowledge that connects them with the world in a multicultural environment. Furthermore, students can build their international social networks during their study at the program, making them future leaders and elites with cosmopolitan visions.

The School of Management of NCU has been accredited by the Association to Advance Collegiate Schools of Business (AACSB). The AACSB is the most recognized form of specialized accreditation in the field of business administration." To catch up with the global trends, the School calls for its top faculty members and develops an innovative curriculum for the IMBA program covering the four major areas—general management, sustainable development, data and decisions, and financial management. The School also signed contracts of dual-

degree master's programs with top universities in the United States, Europe, and Australia, allowing students to acquire the greatest amount of professional knowledge of and practical skills in business administration. The IMBA program aims to become the cradle for cultivating brilliant talent in business administration in the north-central area of Taiwan.

"The School of Management was elected one of the key cultivation colleges for the Program on Bilingual Education for Students in College (BEST) launched by the Ministry of Education in 2021, and the BEST program is likely to extend to 2030 in response to the country's policy on bilingual education," said Professor Meiyu Fang, associate dean of International Affairs of the School of Management, NCU. She indicated that as the IMBA program begins, the School of Management actively internationalizes itself, expecting to have fully English-taught programs in all aspects within ten years. "Though the Covid-19 pandemic refrains students from studying overseas, Taiwan's success in pandemic prevention and control has become an advantage to attract international students," added Professor Fang. "Our School has created an unparalleled internationalized learning environment at home," she continued, "we welcome domestic and international students to explore the new world at the IMBA program!"

International Cultural Day and Study-Abroad Fair Brings You 8 Countries at A Glance

The pandemic has made international movement inconvenient. The Office of International Affairs (OIA) at NCU held the “International Cultural Day and Study-Abroad Fair” at the square of the Teaching and Research Building on Nov. 26 to broaden students’ international vision even when traveling abroad has been restricted. Native students who had joined the exchange program in France, Germany, Sweden, as well as international students from India, Vietnam, Indonesia, the Philippines, and Pakistan were invited to this event to set up exhibition stalls. The students at each stall introduced the distinctive culture of their countries and shared the customs of their local daily life. They moved their hometowns to NCU, allowing visitors to experience the culture and customs of eight countries without traveling abroad.

On the day of the event, students worked hard to set up their exhibition stalls imbued with their cultural features. Greetings in different languages were written on the signboard of each stall, which was a brilliant idea. The feature games and snacks were offered for taste, and the traditional costumes and instruments were also provided for visitors to try on

and to play. All these activities not only made visitors feel as if they were traveling abroad, but also created an immersive sensory experience.

Besides the above interactive activities, OIA also organized a scavenger hunt that integrated the activities of collecting points and gifts for questionnaires. Students were not just giving a passing glance at the event but were having a cultural exchange with depth in the game-playing process. Even the pandemic could not keep visitors away from their willingness to cast their vision at the future and to step into the global village.

Dr. Hsieh-Lung Hsu, Vice President for International Affairs, pointed out that the opportunities for students to study abroad have been greatly reduced due to the pandemic. OIA, thus, held the International Cultural Day and Study-Abroad Fair. Through the scavenger hunt, we hoped to increase the communication between international and native students. We also expected that the splendid cultural experience of each country at the event could broaden students’ worldview of globalization. Let students see the world and understand the world, and then let the world see you.



▲ The “International Cultural Day and International Education Fair” held by the OIA displayed the cultures and customs of eight countries. Photo by Kuo Yu-Tzu

2021 NCU Photo Contest for Ten Campus Scenes: Discover the Beauty of NCU

◀▲ The photo titled “There’s No Distance Between the Lake and Me” taken by Lee, Cahng-Wang, master’s student at the Dept. of Business Administration, won first place of the 2021 NCU Photo Contest for Ten Campus Scenes.
Photo by Lee, Cahng-Wang

The “2021 NCU Photo Contest for Ten Campus Scenes” held by the Office of Secretariat and the Art Center at NCU attracted 106 contestants including faculty members, staff members, students, and alumni of NCU. A total of 226 works were submitted to the contest. After fierce competition and evaluation, the photo titled “There’s No Distance Between the Lake and Me” taken by Lee, Cahng-Wang, a master’s student at the Department of Business Administration, stood out and won the first place.

NCU held an activity on its 106th anniversary to vote for the new ten scenes at NCU for 2021. In order to promote the new ten scenes, NCU held a photo contest, hoping to capture the beauty of NCU through camera lenses and preserve beautiful and valuable images for the university. The top three of the most popular campus scenes for photo shooting were the NCU Lake, the NCU Library, and the Hundred Blossoms Brook. The majority of the contestants were students, which made up 71% of all contestants.

Faculty and staff members made up 20% of all contestants, and alumni, 9%.

First place went to EMBA student Lee, Cahng-Wang for his work “There’s No Distance Between the Lake and Me.” The judges commented that the work had an explicit subject, the composition of the photo was creative, and the atmosphere conveyed by the photo was fabulous. Second place went to another EMBA student, Huang, Chin-En, for his work “A Turning Course of Life.” The work adequately expressed that learning is an endless curvy route. Professor Chou Hsien-Ter at the Department of Civil Engineering won third place for his “A Rest Between Pines.” The three elders in the photo and pines’ significance of longevity echo with each other, which is a fine match between images and implied messages.



Research Team Led by Prof. Ching-Cherng Sun Developed the LED Beams that Touch the Sky

▲ The LED device designed by the research team led by Professor Ching-Cherng Sun projected the LED beams that could reach a distance up to 12 kilometers. It looked just like the beams touched the sky.

When night fell upon the campus, brilliant beams of light reached the sky from a side of the blue track and field stadium at NCU, attracting many people's attention. The research team led by Professor Ching-Cherng Sun from the Department of Optics and Photonics at NCU developed an LED device, which could project the LED beam that could reach a distance up to 12 kilometers. Their research result was published in an SCI journal, *Crystals*.

Professor Sun's research team adopted a special optic design and successfully fabricated a projector lamp with an "extremely narrow beam angle." When the lamp projects light into the night sky, the light beam is brilliant. The team set up a base on top of the Kwoh-Ting Optics and Photonics Building; 144 arrays of light sources illuminated simultaneously, which could be seen from afar. The demonstration became a highlight at NCU that night.

Professor Sun indicated that an LED lamp that projects a light beam that could reach a distance of 12 kilometers is not created for grandstanding. However, the lamp can

light up the sky for travelers and help them see their path more clearly. Anonymous heroes hide in the capital of optics, working hard silently. They have made profound theories more accessible.

Interestingly, this light beam had ever exerted magical power many years ago. The light source was split into two parts, and the principle of the "impulse response" was applied to help FORMOSAT-5 carry out photographic calibration as the satellite was launched into the sky. FORMOSAT-5 captured the images of two special patterns in space 400 to 500 kilometers away from the earth. When the images came in, the whole research team was very excited. It was sort of a surprising reward!

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