Research at SIMIT

SIMIT has three national-level key laboratories (the State Key Laboratory of Transducer Technology, the State Key Laboratory of Functional Materials for Informatics, and the National Key Laboratory of Microsystem Technology) and two CAS key laboratories (the CAS Key Laboratory of Wireless Sensor Networks and Communications, and the CAS Key Laboratory of Terahertz Solid-State Technology). Moreover, it includes the Center for Excellence in Superconducting Electronics (CENSE), a CAS-affiliated center aiming to be a global competitor in superconductor technology.

The mission of scientific research at SIMIT is to carry out strategic, innovative, and forward-looking studies, promote breakthroughs in key technologies and integrated innovation, provide systematic solutions, and consequently contribute to the development of information technology, advanced materials, and micro-/nanotechnologies. SIMIT fully exploits its advantages in two disciplines—electronics science and technology, and information and communications technology—to create a development strategy consisting of “three major breakthroughs and five top priorities.”

Three major breakthroughs

Intelligent sensing Microsystems (ISMs)

As China’s pioneer in wireless sensor networks and the Internet of Things (IoT), SIMIT is devoted to providing comprehensive solutions for public security, smart city planning, and industry IoT. The institute boasts a wide range of competencies, from sensor development and equipment to telecommunications, data processing, networking, and much more, and uses many powerful tools, such as big data and artificial intelligence, to meet its research goals.

Superconducting quantum devices and circuits

SIMIT is devoted to fundamental scientific research on novel quantum materials, such as superconducting heterostructures, sensors, detectors, and digital circuits. It is focused on developing China’s proprietary advanced superconducting core electronic devices, and producing integrated systems with superior performance advantages compared to conventional technologies.

Advanced silicon-based materials and applications

SIMIT is devoted to the research, key technology development, and industrialization of 12-in. silicon wafers and engineered substrates, such as fully depleted silicon-on-insulators (SOI), radio frequency (RF) SOI, power SOI, microelectromechanical system (MEMS) SOI, radiation-hardened SOI, gallium nitride (GaN) on silicon, etc., for China’s semiconductor and microelectronics industries. The institute is also working intensively on the development of electronic and optoelectronic circuits based on SOI materials.

Five top priorities

Special broadband wireless communication technologies and equipment

SIMIT gives priority to advanced broadband wireless communication technologies, such as concurrent transmission using orbital angular momentum and signal energy, for emergency management, high-speed railways, and smart power grids.

Micro- and nanotechnologies for sensors and transducers

SIMIT gives priority to research on state-of-the-art microelectromechanical-system/nanoelectromechanical-system (MEMS/NEMS) technologies for physical, chemical, biochemical, implantable, and combo sensors, as well as hyperspectrum detection Microsystems.

Phase-change random-access memory (PCRAM) and applications

SIMIT gives priority to researching phase-change materials, engineering phase-change random-access memory (PCRAM) chips, and understanding the underlying mechanisms responsible for the low power, high speed, and high reliability of these products.

Terahertz (THz) solid-state technologies

SIMIT gives priority to research on THz quantum cascade lasers, quantum-well photodetectors, interactions between THz waves and various substances, millimeter-wave monolithic integrated circuits (ICs), and inspection imaging equipment with terahertz/millimeter waves.

Brain-inspired chips and bionic vision

SIMIT gives priority to R&D on brain-inspired chips and bionic vision systems, including binocular image signal processing (BISP) chips, sensors that mimic our five sense organs, and robotic limbs.
At modern China’s oldest national institute, a mission unchanged since 1928, and a deep commitment to S&T development.

Achievements
SIMIT has been the recipient of 48 national science and technology awards in the past 90 years, including a special National Science and Technology Progress Award for “Fabrication Technology for Type A Separation Membrane,” and two First Class National Science and Technology Progress Awards for “High-Speed and Ultra-High-Speed Bipolar Digital Integrated Circuits” and “Research and Industrialization of Silicon-On-Insulator (SOI) Materials.” Additionally, SIMIT won the Second Prize of the National Natural Science Award for developing the Lei-Ding Equation, an equilibrium theory of carrier transport in semiconductors.

Because of its advances in wireless sensing and broadband communications, SIMIT made significant contributions to relief efforts after the tragic earthquakes in Wenchuan and Yushu counties. Other achievements include intrusion-prevention systems at the Shanghai World Expo and Pudong International Airport, a security system for the central line South-to-North Water Diversion Project, and other IoT application demonstration projects.

Within the last decade, SIMIT has developed a series of high-performance superconducting nanowire single-photon detectors (SNSPDs), including the recent success of a compact cooler-based SNSPD with a detection efficiency of over 90%. Superior performance has been demonstrated in many applications, such as the record 404-km, measurement-device-independent quantum key distribution achieved in cooperation with our partners at the University of Science and Technology in Hefei, China.

SIMIT has conducted research into SOI technology for more than 30 years. It has incubated China’s sole SOI manufacturing base, Shanghai Simgai Technology Co., Ltd., and developed the country’s first SOI wafer. Through international collaboration, Simgai products have expanded to include most SOI application areas, including power SOI, RF SOI, and radiation-hardened SOI materials, among others.

Talent
To meet the strategic goals of the 13th Five-Year Plan, many changes have been made—both macro changes at the institute level and microadjustments at the laboratory level—to recruit more talent to join the SIMIT family. Over the years, SIMIT has built a dedicated, highly educated team of professionals who have made important contributions in their respective research fields—including two CAS academicians, one foreign associate of the U.S. National Academy of Sciences, and other experts recognized by various national talent programs.

As of the end of 2017, the institute had 1,304 full-time staff members, including 610 full-time research employees (of whom 87 were professors and 125 were associate professors), as well as 644 graduate students and 50 postdoctoral researchers.

At SIMIT, we guarantee that the talents of staff members, students, and postdoctoral researchers will be profoundly supported. We will encourage mutual understanding, trust, tolerance, respect, and appreciation among everyone, so that a positive culture will be established at the institute.

International cooperation
SIMIT continually seeks international collaboration and exchanges. We have exchange programs and collaboration projects with research institutes worldwide—in countries including the United States, Japan, France, and Canada, among others—in areas such as advanced silicon-based materials, micro-/nanosensor technology, bioelectronics, terahertz solid-state technology, PCRM technology, superconductivity, etc. For example, our collaboration with Forschungszentrum Jülich GmbH, an affiliate of the Helmholtz Association, has led to the establishment of the Virtual Joint Institute on Functional Materials and Electronics.

Future
Looking to the future with an open-minded attitude, SIMIT aims to leverage its strengths in the disciplines of electronics science and technology, and information and communications technology, to achieve further success in research, development, and industrialization. By addressing key challenges in the areas of intelligent sensing microsystems, superconducting devices and circuits, and advanced silicon-based materials, we hope to push the boundaries of innovation and the wider adoption of cutting-edge technologies. Our goal is to become an internationally recognized center for research excellence. Meanwhile, we wish to make a significant contribution to the development of information technology, network technology, and communications technology in China.

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“Global Ocean Summit (GOS)” is a high-level forum initiated by Qingdao National Laboratory for Marine Science and Technology (QNLM). Focused on the theme of “Building Partnerships on Ocean Observation and Research”, the Summit explores solutions to challenges in marine science and technology resulted from economic development and global environmental change. It advocates for setting up an internationally open network, strengthening collaboration in marine research and observation to inform its use and sustainability, ensuring equal access to information on ocean preservation and utilization, promoting the sharing of observation and education resources and advancing the sharing of infrastructure and facilities.

Following the 1st GOS held in Qingdao, China during 26-28 September 2016, as the 2nd GOS, GOS2018 will be scheduled at Qingdao, China during 3-5 July 2018, and co-organized by QNLM, Science/AAAS and Department of Science & Technology of Shandong Province and supported by Qingdao People’s Association for Friendship with Foreign Countries.

QNLM, as the initiator of GOS and the unique national laboratory in China, is launched in 2015 with Professor Lixin WU, Fellow of the Chinese Academy of Sciences, as its director. Being committed to build a world-class comprehensive research center of marine science and technology as well as an open platform for collaborative innovation, besides constructing the functional labs, joint labs, open studios, and centers for facilities and infrastructure collaborative with research institutions and enterprise domestic and overseas, QNLM jointly constructs the international Laboratories and centers with world-class institutions, including the Centre for Southern Hemisphere Oceans Research (CSHOR), the International Laboratory for High Resolution Earth System Prediction (iHESP), and the being constructed international joint center with Woods Hole Oceanographic Institute. More information about QNLM can be referred to www.qnlm.ac.

GOS2018 will inherit and develop the spirits of the “2016 Summit Declaration”. Focusing on the global ocean observation and prediction, deep-sea research, polar seas research, and ocean sustainability, the event will be an opportunity to improve the sharing of technology and experience, promote the sharing of marine research infrastructure and facilities, and facilitate the initiating of international program, and finally contribute to a community of common destiny.

We sincerely expect the leaders and representatives to join this big event with us and share your experience. The participants are encouraged to give your poster and/or video exhibition in the meeting on your insight relative to the four topics mentioned above. The size requirement for the poster is 93cm x 192cm, and the ratio for the video is 16:9 with MP4 format. It would be very appreciated if you could send us the message for your poster and video exhibition to the email address jwzheng@qnlm.ac before 20 June, 2018.

Participants are encouraged to register for the conference as early as possible to facilitate the conference organizing committee in arranging the accommodation and to ensure that your reservation requirements are met.
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