Laureates of TKK Young Scientist Awards 2016

Award in Mathematics and Physics

Awardee: CHEN Yu'ao

Under the mentorship of Prof. PAN Jianwei, CHEN received his master's degree from the University of Science and Technology of China (USTC) in 2004 and his Ph.D. degree from the University of Heidelberg in 2008. He then joined the QUANTUM group at the University of Mainz as a postdoctoral researcher and subsequently moved with the group to Max-Planck Institute for Quantum Optics and the Ludwig-Maximilians University, where he became the project leader for the experiment of ultracold bosonic quantum gases in optical super-lattices. In 2011, he was selected as a "Youth Thousand Talent Plan" scholar by the "Recruitment Program of Global Experts" and then appointed as a professor at USTC.

Prof. CHEN's current research focuses on quantum manipulation of photons and atoms including the further development of multi-photon entanglement research, fundamental research on long-distance free-space quantum communication, exploration of atomic-ensemble based quantum memory and the study of ultra-cold atoms in optical lattices based quantum many body physics. He has authored or co-authored over 40 peer-reviewed publications that have attracted over 3300 citations.

In recognition of his "outstanding achievements in the fields of multi-photon entanglement, quantum communication, quantum computation and quantum simulation based on manipulation of photons and atoms", the European Physical Society recently awarded him the 2013 Fresnel Prize for fundamental aspects. And later he received the "Qiu Shi Outstanding Youth Scholar" from the Qiushi Science & Technologies Foundation. Meanwhile, in 2013, he was appointed as the Chief Engineer for Quantum Communication Beijing-Shanghai Backbone project, whose objection was to build a quantum secure communication network from Beijing to Shanghai over more than 2000 kilometers.

Award-winning Achievement:

Experimental Research in Quantum Physics and Quantum Information

Abstract:

Quantum information science is a new field of science and technology, combining and drawing on the disciplines of physical science, mathematics, computer science, and engineering. Since the mid-1990s, quantum information science has been a new interdisciplinary research field with the potential to trigger revolutionary advances in the fields of computation and communication by exploiting the information theory and the physical law of quantum mechanics. CHEN Yu'ao has been working on experimental quantum foundations. He did his best to develop the techniques of quantum control with photons and atoms, which have been systematically applied to quantum communication, quantum computation, quantum simulation, and *etc*. Together with his colleagues, he has performed a number of significant experiments in the field. He has realized for the first time in the world five- six- and eight-photon entanglement and kept the records. Based on the multi-photon entanglement, he has demonstrated quantum teleportation and entanglement distribution over 100-kilometer free-space channels.

Based on an eight-photon cluster-state, he experimentally realized the topological error correction, which has highest tolerable error threshold in quantum computation and represents an important step towards large scale quantum computing. Further, together with his colleagues, he has systematically developed the atomic ensemble based quantum memory with long storage time and high retrieve efficiency. He has realized memory-built-in quantum teleportation between photonic and atomic qubits, which realized an interface between photonic and atomic qubits. Based on such an interface, together with his colleagues, he, for the first time in the world, entangled two atomic ensembles with entanglement swapping. Together with the built-in storage ability, it is a first demonstration of quantum repeater. All these achievements have pave the way to scalable quantum information processing.

Award in Chemistry

Awardee: CHEN Peng

CHEN Peng currently works as a professor of chemistry at Peking University. Born in June 1979 in Lanzhou, China, he received his double bachelor degrees in chemistry and economics from Peking University in 2002. He then went to USA and obtained his Ph.D. in chemistry from The University of Chicago in 2007. After a postdoctoral training at the Scripps Research Institute from 2007 to 2009, he returned to Peking University in July 2009 as an Investigator at the College of Chemistry and Molecular Engineering (CCME). He was promoted to full professor with tenure in August 2014 and since January 2015 serves as the Chairman of Department of Chemical Biology, CCME.

Prof. CHEN's main research interest is in chemical biology. He has made important contributions to the fields of protein chemical biology, bioortogonal reactions and host-pathogen interactions. In particular, he has made major accomplishments in developing chemical tools to study proteins in living cells. These technological advancements have helped overcome the traditional bottleneck for investigating intracellular proteins, which opens a new avenue for *in situ* study of protein functions as well as illustration of new biological mechanisms. In the above-mentioned areas, he has published over 40 papers in peer-reviewed journals over the past five years, including six papers in Nature Group Magazines (*Nat. Chem*. and *Nature Chemical Biology*, *etc*.), 10 papers in *J. Am. Chem. Soc*. and *Angew. Chem. In. Ed*. He has also co-authored three books, including one with the National Natural Science Foundation of China (the *Chemical Biology Frontier and Perspective*) and two chemical biology textbooks, namely the *Principles of Chemical Biology*, and the *Chemical Biology Experiments*.

Prof. CHEN's contributions have been recognized by a number of international and national academic honors and awards, including the "Wuxi PharmaTech" Life Science and Chemistry Award (2011), the Chinese Chemical Society Young Investigator Award (2012), Young Scientists Award of China (2013), Roche Chinese Young Investigator Award (2014), "CAPA Biomatik" Distinguished Faculty Award, RSC Chem. Soc. Rev. Emerging Investigator Lectureship (2014), The Chemical Society of Japan Distinguished Lectureship Award (2015), *etc*. He received the Distinguished Young Scholar from the National Natural Science Foundation of China (NSFC) in 2012 and became an NSFC Innovation Research Team Leader in 2015.

Prof. CHEN currently serves as Vice Chair of the Chemical Biology Committee of Chinese Chemical Society, and is a member of the Young Chemist Committee of Chinese Chemical Society. He has been serving as editor or advisory board member for a panel of scientific journals, including *Acta Chimica Sinica*, *Scientific Reports*, *Molecular BioSystems*, *Chem*, *Cell Chemical Biology*, *Chemical Society Review*, *etc*.

Award-winning Achievement:

Protein Chemistry in Living Cells

Abstract:

As the basic building blocks for all living species, cells play fundamental roles in virtually all life processes. Proteins are the most abundant biomolucules in cells, and their structure, activity, movement as well as interactions with other biomolecules lay the ground for diverse cellular functions. How to specifically label and manipulate proteins within their native environment—the living cells, however, remains a formidable challenge. CHEN Peng and coworkers systematically developed chemistry-based platform technology for *in vivo* studies of proteins, which yielded an array of chemical biology tools such as photocrosslinking, labeling and chemical de-caging probes to investigate protein structure and functions under living conditions. Embarking on this novel "chemistry toolkit" for living cells, they collaborated with biologists to reveal the intracellular molecular details during conformational change, activity modulation, post-translational modification and biomolecular interactions of a panel of essential protein machinery. The work opens a new avenue for using the chemical approach to investigate protein as well as other biomolecules, which significantly enriched the methodologies for understanding protein functions *in vivo*. Such study also revealed new mechanisms underlying bacterial antibiotic resistance and acid resistance, and illustrated new pathways during cell signal transduction, which provides new therapeutic potential for infectious disease and cancer.

Award in Information Technical Sciences

Awardee: ZHOU Kun

ZHOU Kun received his B.S. and Ph.D. degrees from Zhejiang University in 1997 and 2002, respectively, and currently works as a Cheung Kong Professor for the Computer Science Department of Zhejiang University, as well as the Director of the State Key Lab of CAD & CG. Prior to joining Zhejiang University, he worked for Microsoft Research Asia for six years.

Prof. ZHOU's research interest is in visual computing and virtual reality. He has published more than 100 papers in peer-reviewed conferences and journals, including 70^{+} papers in ACM/IEEE Transactions, with 5000^{+} citations. He currently serves on the editorial/advisory boards of *ACM Transactions on Graphics*, *IEEE Spectrum*, *Frontiers of Computer Science* and three other journals. He was named one of the world's top 35 young innovators by *MIT Technology Review* in 2011. He is a Fellow of the IEEE.

Award-winning Achievement:

Efficient Parallel Rendering of Photorealistic Graphics

Abstract:

Real-time, photorealistic rendering of large-scale scenes is the key supporting technology of many applications such as virtual reality, cultural and creative industries. It is also a grand challenge for modern computer graphics research. One effective solution to addressing this challenge is to perform parallel rendering on GPU hardware and rebuild the rendering pipeline. This requires significant changes to the traditional graphics data structure, rendering algorithms and pipelines. Prof. ZHOU Kun proposed parallel construction and accessing methods for data structures widely used in photorealistic graphics, established the parallel photorealistic rendering pipeline suitable for GPU hardware, designed efficient GPU parallelization methods for classical rendering algorithms, and developed parallel photorealistic rendering software with independent intellectual property rights. His work, for the first time, demonstrated the feasibility of realizing movie-quality photorealistic rendering at interactive speeds, took the lead of research direction of GPU-based parallel photorealistic rendering in academic circles, and laid the foundation for industrial development of GPU-based photorealistic rendering systems.