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## Associate Editor's Introduction

At the triennial occasion of the General Assembly and Scientific Symposium (GASS), URSI acknowledges scientific achievements in the field of radio science by awarding outstanding individuals with a number of URSI awards. Two of those awards are "early career" awards, meaning that they are awarded to a young scientist not more than 35 years old on September 30 of the year preceding the URSI GASS. These early career awards are the Issac Koga Gold Medal and the Santimay Basu Prize.

The Santimay Basu Prize is awarded to a young scientist who has made an outstanding contribution to research that furthers the understanding of radiowave propagation in random media and its application for the benefit of society. The award takes into account the excellence of the research, the merit of the candidate in achieving his or her results, and the efforts required to accomplish the research. At the 2017 URSI GASS in Montreal, the Santimay Basu Prize was presented to Dr. Jamesina Simpson with the citation, "For advancing three-dimensional finite-difference time-domain (FDTD) solutions of electromagnetic wave propagation within the global Earth-ionosphere waveguide applied to space weather, remote-sensing, and very-low-frequency propagation."

The Issac Koga Gold Medal is awarded to a young scientist who has made an outstanding contribution to any of the branches of science covered by the Commissions of URSI. The award is for career achievements of the candidate, with evidence of significant contributions within the most recent six-year period. At the 2017 URSI GASS in Montreal, the Issac Koga Gold Medal was presented (Figure 1) to Dr. Yue Li with the citation, "For contributions to the development of electromagnetic metamaterial circuits and antenna designs in mobile communication systems." It is a great pleasure to put Dr. Li in the spotlight in an interview in this column.

# Interview with Yue Li: Winner of the 2017 URSI Issac Koga Gold Medal

*What was your educational background?*

Although I did not get a good grade in the college entrance examination, I was quite fortunate to be the last student (with the lowest grade) enrolled by Zhejiang University, a famous Chinese University in the field of engineering. To prove I was not the worst student, I worked hard in the university and won the qualification of Tsinghua University as a graduate student in 2007. Tsinghua University is the best university in China, and it is a big challenge to graduate. I joined the microwave group of Prof. Zhenghe Feng, who became my PhD supervisor. There, my major was microwave antenna design. After I finished the PhD degree in 2012, I stayed in the same group and started the new topic of metamaterials and circuit design. In December 2013, I joined the group of Prof. Nader Engheta at the University of Pennsylvania, in pursuit of new techniques of fields and waves with a wide range of optics such as metamaterials and nanophotonics. In January 2016, I returned to Tsinghua University as an Assistant Professor.

*How would you describe your career so far?*

With challenges, but interesting and meaningful. The experiences at the University of Pennsylvania and Tsinghua University had taught me how to think about science and technology, how to develop new concepts, and how to apply them in practical engineering. The curiosity of science always pushes me to learn new topics. There are challenges, but your passions will help you to overcome these hurdles. Being an Assistant Professor in Tsinghua University is an interesting career, and you will not easily predict what you will do in the next five years. You are always learning new things and creating new things.

*How did you become interested in your current research field?*

My current research field is technologies in electromagnetics, including antennas, circuits, and metamaterials. The amazing physics behind this applied science made me become interested in this field. You should imagine that by engineering different metallic or dielectric structures, we can control and tame the electromagnetic fields and waves. For example, you can design an antenna to totally radiate in one direction, rather than omni-directionally, or you can tune the scattering light at will just using a layer of metal. Such counterintuitive phenomena fascinate me in pursuit of the technologies in electromagnetics.

*What motivates you in your field of study?*

The difference between pursuing novelties in theory and engineering. For an engineering department, we may focus more on how to put a new technique into practical usage, such as solving new problems, application to new environments, or designing new structures. But for theoretical innovation, a new concept or a new phenomenon is more important, with strict theoretical analysis, numerical simulations, and ideal experiments. The motivation for my research is to overcome this difference, to develop new theory and apply it in practical systems or devices. Challenges are always there, but this is my goal, creating new concepts from theory to engineering.

*Which challenges have you faced during your career?*

In the field of electromagnetics, the topics are quite wide and you need to learn a lot of new concepts. For instance, you need to learn techniques from dc to RF, and from microwaves to optics. You also need to learn fabrication processes and measurements. Learning new things always comes with challenges, but if you are passionate about it, it is quite interesting.

*What is the current "hot field to study" in your area, and what do you think it will be in the future?*

In my opinion, the circuit concepts inspired by metamaterials form a promising topic in the field of electronics and optics. As we know, integrated-circuit techniques change our daily life as we use such lumped circuits in electronic devices, such as computers, mobile phones, and so on. However, existing circuit techniques only operate up to a few gigahertz, i.e., microwave range, which limits the signal-processing rate and wireless-data-transfer speed. If we can achieve the integrated-circuit idea in the optical domain, we may easily design a supercomputer with the dimensions of a cell phone, and we may transfer an HD movie in just one second. However, the materials hindered the development of such great circuits in the optical domain, as we no longer have metal or less-dispersive dielectrics in the optical domain. Even though nature did not provide the materials we need, we can artificially design materials with such properties, and this is the motivation for the topic of metamaterials. Based on the concept and advanced design of metamaterials, we may translate the techniques from the microwave range to the optical range, leading to the development of new technologies and theories. Among them, the lumped-circuit design is the most significant in the optical domain, not only to design components and devices at sub-wavelength scale, but to increase the rates of signal processing and data transfer. Wireless communication will come to a new generation.

*What fascinates you most in your current position?*

The new ideas in science and technology, the smart students, and the creative colleagues. The most fascinating moment is the feasibility of a new idea, which is successfully published in a paper or adopted in engineering projects.

*Which achievements earned you the Issac Koga Gold Medal?*

I think there were three contributions for the Koga Gold Medal.

First, there was the idea of lumped circuitry inside a waveguide, also named "waveguide metatronics." Based on this idea, we can design lumped circuits using waveguide metamaterials in different ranges, such as the microwave domain, the terahertz domain, and the optical domain, breaking the limitations of material selections.

Second, the development of photonic doping, which transplants the doping idea from the microscopic scale to the macroscopic scale. We can easily control the magnetic properties of an epsilon-near-zero medium by tuning the parameters of an inserted dielectric rod, such as the diameter and permittivity. This is also a new paradigm of metamaterials without using periodic structures.

Third, for the contribution to mobile antenna design. In this topic, advanced techniques of multiple-domain cooperation (such as the spatial, time, and frequency domains) are used to design multiple antennas within a small volume, with the merits of high isolation, small dimensions, and omnidirectional radiation. Such ideas can be adopted in the design of mobile-phone antennas, base-station antennas, and access-point antennas.

*Which opportunities/persons have been instrumental for your career so far?*

There are three persons with a significant impact on my career. The first two I met in my graduate-student pursuits in the microwave group of the Department of Electronic Engineering at Tsinghua University. I met my supervisor, Prof. Zhenghe Feng, and my co-supervisor, Prof. Zhijun Zhang. They brought me into the antenna world. They were experienced professors in microwave techniques, and taught me how to find and solve problems in practical projects. By accumulating experience in engineering, I can find new problems from the engineering point of view. The third person I met during my days in Prof. Nader Engheta's group in the University of Pennsylvania. Prof. Engheta is a scientific giant in the field of metamaterials and nanophotonics. He taught me how to theoretically solve a problem and helped me to think theoretically. These three great professors taught me not only in science and technologies, but also how to be a good person. They started my career of academic life.

*What do you hope to achieve in the coming years?*

First, as a professor, I hope to successfully teach. In my class of antennas and metamaterials, I hope more students will become interested in such areas, and I can help them to do research on these topics.

Second, I hope my research will have good progress. We have lots of interesting ideas, but need to prove them theoretically and experimentally. I hope my group members will have more great achievements in the fields of antennas and metamaterial-inspired circuits.

*What advice would you give to students or early-career researchers?*

I am also an early-career researcher. I am glad to share some experience with other early-career researchers, and also with students. At the beginning, everything is tough, and we need to be optimistic, even though the reality is different. We may have to face more failures than successes. We need to maintain our passion. The joy of discovery in science and technology comes from passion. Even though you choose a "cold" area, passion will lead you to excellent research and great achievements. Please believe your passion, which will be leading you to get your goals.

## A Short Biography of Yue Li

Yue Li received his BS in Telecommunication Engineering from Zhejiang University, Zhejiang, China, in 2007, and his PhD in Electronic Engineering from Tsinghua University, Beijing, China, in 2012. He is currently an Associate Professor in the Department of Electronic Engineering at Tsinghua University. In June 2012, he was a Postdoctoral Fellow in the Department of Electronic Engineering, Tsinghua University. In December 2013, he was a research scholar in the Department of Electrical and Systems Engineering, University of Pennsylvania. He was also a visiting scholar at the Institute for Infocomm Research (I2R), A*STAR, Singapore, in 2010, and at the Hawaii Center of Advanced Communication (HCAC), University of Hawaii at Manoa, Honolulu, HI, USA, in 2012. Since January 2016, he has been with Tsinghua University.

He has authored and coauthored over 80 journal papers and 30 international conference papers, and holds 15 granted Chinese patents. His current research interests include metamaterials, plasmonics, electromagnetics, nanocircuits, mobile and handset antennas, MIMO and diversity antennas, and millimeter-wave antennas and arrays. He was the recipient of the Issac Koga Gold Medal at the URSI General Assembly and Scientific Symposium in 2017; the Second Prize of Science and Technology Award of China Institute of Communications in 2017; the Best Student Paper Award (Third Prize) from APCAP 2017; the Young Scientist Award from URSI AP-RASC 2016; the Young Scientist Award from EMTS 2016; the Best Student Paper Award form ICMMT 2016; the Best Paper Award form ISAPE 2016; the Young Scientist Award from URSI GASS in 2014; the Outstanding Doctoral Dissertation of Beijing Municipality in 2013; and the Principal Scholarship of Tsinghua University in 2011. He serves as an Associate Editor of the *IEEE Transactions on Antennas and Propagation* and the *IEEE Antennas and Wireless Propagation Letters*.

**Figure 1. The Issac Koga Gold Medal being presented to Dr. Yue Li (r) by Prof. Kazuya Kobayashi during the opening ceremony of the 2017 URSI GASS in Montreal, Canada.**