

Powering DISCOVERIES!

April 2011



Microwave Pioneer in IHPC



■ Professor Hoefler in Shanghai.

IHPC's Professor Wolfgang Hoefler has been recognized by his peers as an authoritative pioneer in the field of microwave research. He shares his thoughts here.

Professor Wolfgang Johannes Reinhard Hoefler will be receiving the prestigious "Microwave Pioneer Award" from the IEEE Microwave Theory and Techniques (MTT) Society.

The citation: "For pioneering contributions to time domain computational methods in microwave engineering, in particular the transmission line matrix (TLM) method." The Award will be presented at the IEEE MTT-International Microwave Symposium Awards Banquet, to be held in Baltimore this June. Prof Hoefler said: "Receiving this award is particularly meaningful to me. The members of the MTT Society are the most highly qualified peers to assess my contributions. Therefore, this award is not just a nice accolade, but a credible and substantial recognition."

"I feel very honored and gratified indeed."

The MTT Society presents annual awards to outstanding members of the microwave community for contributions made to the field of microwave technology and engineering. Details about the MTT Society Awards can be found at www.mtt.org/awards. It should be noted that

the organisation did not give out the Microwave Pioneer Award last year.

Research

Prof Hoefler's research in microwave engineering and computational electromagnetics has helped to shape the technologies and design tools for analogue microwave and high-speed digital communication systems.

At IHPC, Prof Hoefler is conducting research on metamaterial modelling with emphasis on super-resolution imaging and electromagnetic cloaking.

He said: "While the direction of my research will not change, my belief in the importance of quality in research will be stronger than ever. My research at IHPC remains a continuing journey, but this award is a milestone suggesting that, perhaps, I have travelled in the right direction."

He is also, concurrently, the Director of the Independent Investigatorship (I³) Department in IHPC, and also an advisor to the Electronics and Photonics (EP) Department.

To Prof Hoefler, quality in research requires not only skills, dedication and hard work, but more importantly, in-depth understanding and broad integration of concepts, knowledge and experience – the hallmarks of personal growth for a researcher, in other words.

He added: "This growth should transcend the realm of science and engineering. I strongly concur with the statement by the leading Japanese android scientist Hiroshi Ishiguro, that the capacity to innovate requires an artistic spirit: 'Art will be technology by giving methodology to the art. That is, engineering and technology are a part of art.'"

Prof Hoefler is modest about his latest award, which joins his long list of awards and citations in marking his contributions to his field. Instead, he prefers to pay tribute to all who have helped him.

"In the big picture of human achievement, my modest contribution is barely a tiny pixel, but on a personal level, the recognition by my peers validates not only my own professional legacy, but also the precious contributions of my colleagues, former students and research associates."

"I gladly share this award with them." ❖

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More about Prof Hoefler

We know him as the Director of Independent Investigatorship (I²) Department here in IHPC, but those new to the Institute might not know the following details.

Prof Hoefler is an IEEE Life Fellow (F'91, LF'06), and a Fellow of the BC Advanced System Institute (1992), Fellow of the Royal Society of Canada (2003), Fellow of the Canadian Academy of Engineering (2009), Fellow of the German Academy of Science and Engineering (ACATECH, 2007), and Fellow of the Electromagnetics Academy (MIT, 1992).

He advanced the CAD of planar and E-Plane circuits, pioneered the application of Finite Difference Time Domain (FDTD), Transmission Line Matrix (TLM) and Multiresolution Time Domain (MRTD) methods in microwave circuit design, and spearheaded the development of modern time-domain TLM electromagnetic field simulators.

In addition, his modelling technology forms the basis of the EM Simulator MEFISTo, that was commercialised by Faustus Scientific Corporation.

Unveiling the behavior of hydrogen molecules

IHPC's William Yim from Materials Science and Engineering (MSE) Department was part of a research team that made an impactful discovery.

Dr William Yim had the opportunity to collaborate with Toshiaki Itaka from Riken Advanced Science Institute and Prof John Tse from Canada's University of Saskatchewan last year.

The team of researchers discovered the physical basis to explain the newly discovered vibration behavior of molecular hydrogen, including hydrogen bound to silicon and called silane, under high pressure.

The two-month project resulted in a paper, 'Pressure-induced intermolecular interactions in crystalline silane-hydrogen', that was published in Physical Review Letters 105.

The cross-disciplinary team was like a dream team, made possible by the mutual introductions given by Prof John Tse and Dr Wu Ping, IHPC's Director of Material Science and Engineering Department.

Said William: "Prof. John Tse's expertise on experimental and computational research on

materials science and he is famous in high pressure research field. Dr Toshiaki Itaka is a permanent staff in Riken working on solid state researches and program development for linear scaling computational method.

As William himself has a track record on ab initio vibrational frequency calculations applying to surface science, it was a good match of expertise.

His motto is "Be Prepared", so the challenge of taking on the project was a welcome one.

"I like to learn new skills, and I made sure I learnt all the necessary computational techniques before this project. Good preparation and speed are the key factors in benefitting from such a good opportunity."

It was a classic collaboration case study, in which everyone played an important role in making the breakthrough.

William said: "When Prof Tse mentioned an interesting problem of H₂ vibron softening, we were well prepared to puzzle out the scientific question."

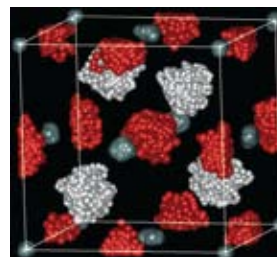
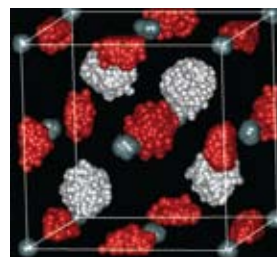
William contributed the 'Donor-acceptor interaction in compression regime', which is a brand new idea.

The team performed molecular dynamic simulations to study the interactions between hydrogen and silane molecules, which gave a better fundamental understanding for the materials under extreme conditions.

The results provided a good basis to potentially develop a hydrogen economy.

Said William: "The knowledge of physical interaction in compressed regime, as indicated by vibrational spectroscopy and chemical bonding, will be very helpful for further engineering the mixing process and hence the H₂ transport capability."

The project is another feather in the cap for IHPC.



■ The images show traces of the position of silane and hydrogen molecules over time.

Dr Toshiaki Itaka, from Riken's Computational Astrophysics Laboratory commented: "It was an exciting experience that I could work with William and IHPC for the study of SiH₄ under pressure. As a physicist, I learned a lot from the chemist's viewpoint of William.

"I also noted that IHPC has strength not only in the academic research but also in its application to important problems in real world. This is what Riken is aiming at, and would like to learn from IHPC."

William too had an enriching experience working closely with the other researchers.

He said: "The most important skill I've learnt is to understand how to translate research work into an impactful and engaging story. It is an art to turn lots of boring numbers into an interesting story so that people can understand the significance of the discovery." ❖