

# PURDUE QUANTUM SCIENCE AND ENGINEERING INSTITUTE

Innovating quantum technologies

## *Quantum Computer, Quantum Parallelism, and Quantum Electromagnetics*

**Distinguished Professor W.C. Chew**

*School of Electrical and Computer Engineering, Purdue University*

Wednesday, December 2, 10 a.m.: [Zoom Link](#)

The recent advent of quantum computer is an exciting milestone in quantum technologies development. It has taken us 70 years to go from vacuum-tube computers to the cell phone computers of nowadays. It will be interesting to envision similar development for quantum computers. In this talk, we will summarize the challenges faced by modern quantum computers. We will illustrate the prowess of quantum parallelism by discussing the quantum Fourier transform. Then we will discuss the quantum Maxwell's equations. In quantum Maxwell's equations, field variables are elevated to become field operators analogous to infinite dimensional matrix operators. Also, in tandem with quantum Maxwell's equations is an infinite dimensional vector describing the state of the quantum system. Therefore, the quantum state equation, which is analogous to the Schrodinger equation, has to be solved. Hence, a quantum electromagnetics system is greatly enriched in information content compared to a classical electromagnetics system. With it, we can model physical phenomena that are regarded as quantum "weirdness", quantum entanglement, and the corpuscular nature of light.



**W.C. Chew** received all his degrees from MIT. His research interests are in wave physics, specializing in fast algorithms for multiple scattering imaging and computational electromagnetics in the last 30 years. His recent research interest is in combining quantum theory with electromagnetics, and differential geometry with computational electromagnetics. After MIT, he joined Schlumberger-Doll Research in 1981. In 1985, he joined U Illinois Urbana-Champaign, was then the director of the Electromagnetics Lab from 1995-2007. During 2000-2005, he was the Founder Professor, 2005-2009 the YT Lo Chair Professor, and 2013-2017 the Fisher Distinguished Professor. During 2007-2011, he was the Dean of Engineering at

The University of Hong Kong. He joined Purdue U in August 2017 as a Distinguished Professor. He has co-authored three books, many lecture notes, over 450 journal papers, and over 600 conference papers. He is a fellow of various societies, and an ISI highly cited author. In 2000, he received the IEEE Graduate Teaching Award, in 2008, he received the IEEE AP-S CT Tai Distinguished Educator Award, in 2013, elected to the National Academy of Engineering, and in 2015 received the ACES Computational Electromagnetics Award. He received the 2017 IEEE Electromagnetics Award. In 2018, he served as the IEEE AP-S President. He is a distinguished visiting professor at Tsinghua U, China, Hong Kong U, and National Taiwan U.