Faculty of Engineering Distinguished Lecture

MICROWAVE PHOTONICS TRANSPORT : DEEP SPACE TRACKING, NAVIGATION, COMMUNICATION; AND TERRESTRIAL BROADBAND INTERNET

Professor Kam Y. Lau
Professor Emeritus, EECS,
University of California, Berkeley

Date: 28th October 2024 (Monday)
Time: 4:00 p.m. – 5:15 p.m.
Venue: LT1A Cheng Yu Tung Building, CUHK (near MTR)

Abstract

Beyond their well-recognized enabling roles in today's Tb/s internet backbone and Gb/s cable and wireless access for homes and businesses worldwide, microwave photonics transport technologies comprising high-speed/high-linearity laser diodes and high-fidelity RF transmission over optical fibers (RoF) are essential to ultrahigh precision arraying of antennas at NASA's Deep Space Network (DSN). For nearly four decades, this RoF system has been central to tracking, navigating, and communicating with ALL NASA's Deep Space (defined as beyond the Moon's orbit) exploration missions. Space-borne versions of this system have enabled high-resolution topographic radar imaging of Earth's land mass from spacecraft in Low Earth orbits. Ground-based topographic radar imaging of the Lunar S. Pole region was carried out with DSN antennas for the selection of landing sites for upcoming crewed missions back to the Moon, fifty-five years after humans first set foot on it. This talk describes these RoF systems in space explorations and their origins in the high-performance laser diodes and RoF technologies developed during the 1980s that enable today's terrestrial broadband connectivity.

Feasibilities for evolving the present RF-based DSN to a future optical-based DSN were demonstrated recently by free-space optical transmission to Earth by a NASA spacecraft 225 Million km away (in the asteroid belt beyond Mars' orbit,) at a bit rate of 267Mb/s (>10 simultaneous 4K videos) : a highly desirable capability for a future human expedition to Mars. These types of RoF systems deployed at the DSN are also critical for operations of all radio telescopes and arrays and high energy particle accelerators worldwide, producing breakthroughs in fundamental physics terrestrially and extra-terrestrially.

Biography

Kam Y. Lau is professor Emeritus in EECS at U.C. Berkeley. He received his B.S., M.S., and Ph.D. degrees from Caltech in 1978, 1978, and 1981, respectively. He was a staff engineer at the NASA Jet Propulsion Laboratory (JPL) from 1979 to 1981, the founding Chief Scientist of Ortel Corp. from 1981-1988, an associate professor of EE at Columbia University from 1988 – 1990, and a professor in EECS at U.C. Berkeley since 1990; assuming Emeritus status in 2005. In addition to Ortel, he co-founded LGC Wireless, Inc. in 1997 and served as its founding chairman.

He has received numerous recognitions for his work that has significantly impacted today's metropolitan high-speed digital fiber-optic internet backbone, cable and wireless broadband internet access at homes/businesses worldwide, as well as Deep Space exploration, radio telescopes and defense systems. They include the 2024 IEEE/Royal Society of Edinburgh James Clerk Maxwell Medal, the 2013 IEEE Aerospace Electronics Systems Pioneer Award, the 2021 IEEE Microwave Pioneer Award, the 2009 IET J.J. Thomson Medal, the 2011 Benjamin Oliver Gold Medal from the International Armed Forces Communications and Electronics Association, the 2022 Distinguished Alumni Award from Caltech, the 2009 IEEE David Sarnoff Award, and the 2008 Optica Holonyak Award. He is a Life fellow of the IEEE and a fellow of Optica.

Besides the Interferometric Synthetic Aperture Radar system enabled by the RoF system he developed at JPL, flown on Space Shuttle Endeavour in 2000 and now displayed at the Smithsonian National Air and Space Museum in Washington D.C., he is most proud of his SIX ink paintings currently in the collections of two art museums, all composed before age 16 when he was at Wah Yan College, Kowloon.

Enquires: Ms Clara Yu (lpyu@ie.cuhk.edu.hk)
Ms Natalie Tsang (Natalie.Tsang@ee.cuhk.edu.hk)

Registration

The lecture is co-organized by Department of Electronic Engineering and Department of Information Engineering.