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Department of Electrical Engineering

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Department of Electrical Engineering &
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Jointly present a Seminar on

Integrated on-chip Lasers for Advancing Post-Moore Performance Scaling

by

Prof. Yating Wan

King Abdullah University of Science and Technology

Date	:	**16 July 2024** (Tuesday)
Time	:	**10:00 am – 11:00 am**
Venue	:	**G5-314, Yeung Kin Man Academic Building** City University of Hong Kong
Language	:	English

Abstract

Integrated silicon (Si) photonics presents a promising solution for addressing the growing demand for data processing capabilities and energy efficiency driven by artificial intelligence and high-performance computing. However, the integration of on-chip lasers has faced challenges due to the indirect bandgap of Si, which limits integration density, production efficiency, and cost-effectiveness. This talk aims to tackle these challenges from two perspectives: monolithic integration through direct epitaxial growth and heterogeneous integration via wafer bonding.

Regarding monolithic integration, recent advancements in individual Si-grown devices will be discussed, along with various approaches for active-passive coupling and co-integration of lasers with other Si photonics components. On the other hand, heterogeneously integrated on-chip lasers, initially developed in our university laboratory, have successfully achieved commercialization in collaboration with Intel® Research Center, generating substantial revenue of over $1 billion in the past decade. However, the current packaging limitations present difficulties in accommodating bulky, lossy, expensive, and complex optical isolators. To address these challenges, we leverage quantum dot (QD) lasers with their small linewidth enhancement factor, providing a more compact and efficient solution that eliminates the need for bulky isolators. Furthermore, QD lasers provide additional advantages such as lower threshold currents, higher temperature stabilities, and enhanced reliability.

Additionally, the talk will delve into the current state of application-driven on-chip silicon lasers and explore their potential applications in various domains, including data communications, biosensors/bioimaging, energy harvesting, machine vision, and quantum information processing. By integrating photonic integrated circuits with on-chip lasers, we aim to inspire further advancements that yield significant performance improvements, environmentally friendly solutions, and mass production capabilities. The ultimate objective is to advance post-Moore performance scaling in electronic systems and explore the potential applications of this integration across the aforementioned domains.

Biography

Dr. Yating Wan is an Assistant Professor at KAUST. Before that, she obtained PhD at HKUST (supervised by Prof. Kei May Lau) from 2012-2017, worked in Prof. John Bower's group at UCSB from 2017-2022 and led Intel's project of Heterogeneously Integrated Quantum Dot Lasers on Silicon. Her research interests are in Si Photonics with special emphasis on integration of on-chip light sources for optical computing. She received 2016-17 School of Engineering PhD Research Excellence Award in HKUST, 2021 CLEO Tingye Li Innovation Prize, 2018 PIERS Young Scientist Award, 2021 OGC Best Young Scientist Award, 2024 Optica Ambassador, and 2022 Rising Stars of Light by Light: Science & Applications. She has published more than 60 peer-reviewed research papers, including 36 first-author journal (24)/conference(12) papers and 10 journal covers. Dr. Wan also held editorial and committee roles for various journals and conferences, including Light, IEEE journals (JQE and JSTQE), Optica journals (Applied Optics), IEEE Photonics Society (IPS) Conference Council and CLEO/IPC conferences.

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