

Doctoral school
Functional materials and nanotechnologies



在ラトビア日本国大使館

Japānas vēstniecība Latvijā

Embassy of Japan in Latvia

Monday, June 26, 13:30, Kengaraga Str. 8, in hall, 2nd floor



Advances in quantum dot lasers - from fundamentals to practical implementation

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Abstract

Since the first proposal of the concept of the quantum dot by Arakawa in 1982, the quantum dots have been intensively studied for both fundamental solid state physics and advanced device applications. By fully discretizing the energy levels of electrons in quantum dots, it has been possible to realize high performance quantum lasers and quantum information devices such as single photon sources. Quantum dots can also be applied to solar cells with a predicted conversion efficiency of 80% for the future sustainable renewable energy system. Moreover, implementing a single quantum dot within the optical nanocavity provides a new platform for investigating solid cavity quantum electronics (QED).

In this lecture, we overview recent progress in quantum dot science and technology, including successful development of quantum dot lasers. Prospects of future photonic devices based on the quantum dots is also discussed.

Short biography

Yasuhiko Arakawa received his PhD degree in Electronics and Electrical Engineering from the University of Tokyo in 1980. He immediately joined the University of Tokyo as an assistant professor and became a full professor at the University of Tokyo in 1993. He is now the Director of the Institute for Nano Quantum Information Electronics, the University of Tokyo. He is also the Director and Professor of the Center for Photonics and Electronics Convergence, Institute of Industrial Science at the University of Tokyo. He currently serves, as the President, to the International Commission for Optics (ICO) and is a Foreign Member of US National Academy of Engineering (NAE).

He has received numerous awards, such as Japan Academy Prize, Medal with Purple Ribbon, Leo Esaki Award, Fujiwara Award, IEEE/LEOS William Streifer Award, IEEE David Sarnoff Award, C&C Prize, Heinrich Welker Award, and OSA Nick Holonyak Jr. Award.