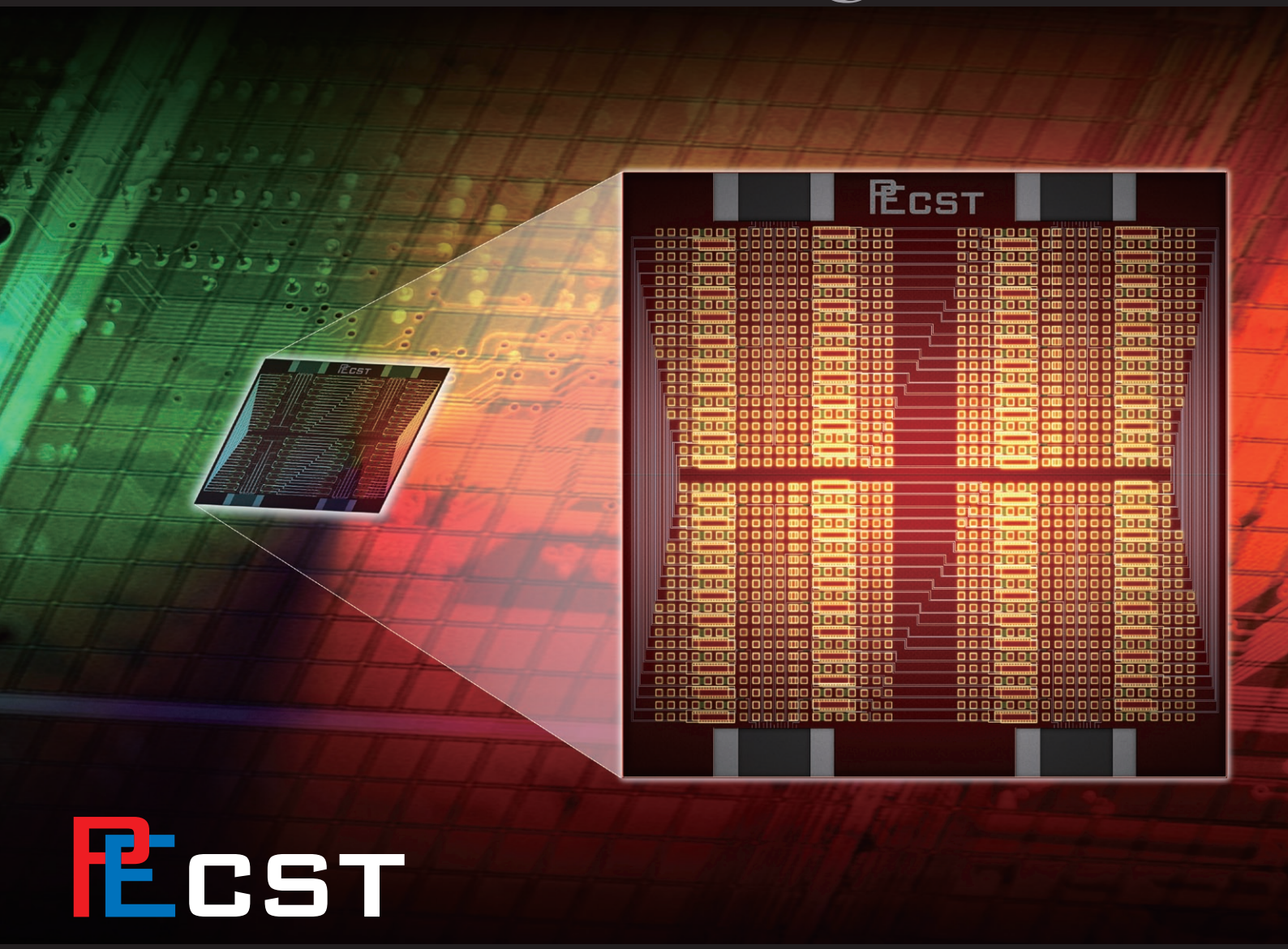
FIRST Program



PECST

Photonics-Electronics Convergence System Technology

PETRA

東京大学 THE UNIVERSITY OF TOKYO

AIST

Message from the Core Researcher

The recent information explosion has caused a further increase in the demands and expectations of computer performance. The PECST (Photonics and Electronics Convergence System Technology) was selected as one of the thirty FIRST projects in order to exceed the limitation of current LSI by converging photonics and electronics. The PECST project is carried out with a total budget of 4.5 billion yen, involving the University of Tokyo, PETRA, and AIST as core organizations. The goal of this project is the demonstration of the LSI and photonics integrated systems for future of on-chip data centers, including silicon-based optical interconnect technology. We believe that the PECST will show the way to a new paradigm which will bring innovations to the industry. For this purpose, strong collaboration beyond existing organizations such as companies and universities is essential. I, as core researcher, together with all our outstanding project members from both academia and industry, will make upmost efforts to making the PECST a successful project. We hope all of you will strongly support and encourage us to achieve the aims of the PECST.

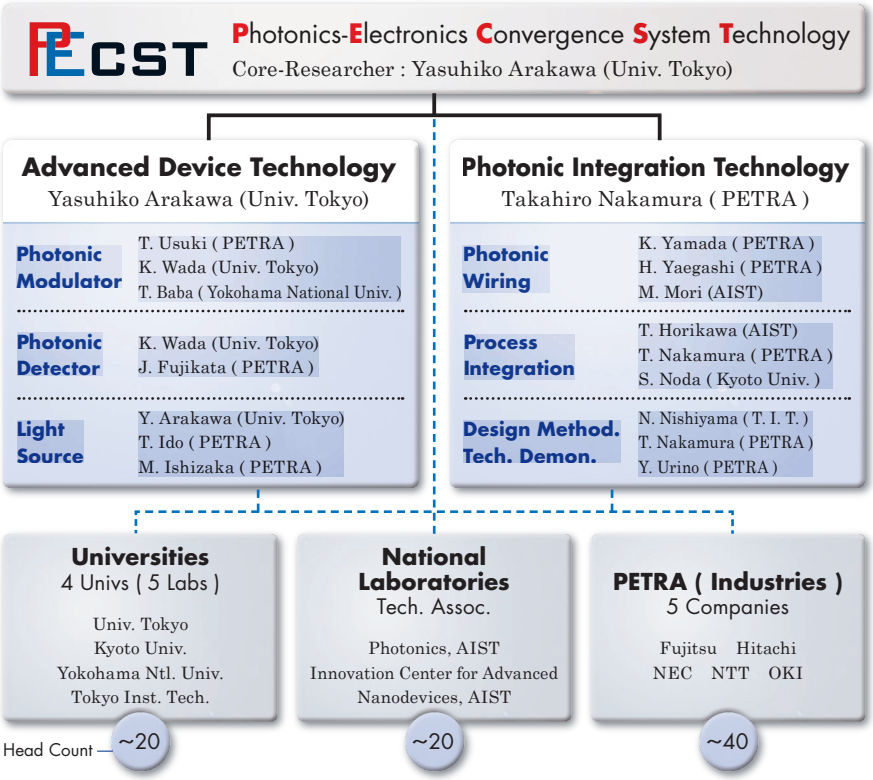
Yasuhiko Arakawa,
Core Researcher, PECST,
Professor,
The University of Tokyo

About FIRST

The Funding Program for World-Leading Innovative R&D on Science and Technology (FIRST program), which was planned by the Council for Science and Technology Policy in the Cabinet Office, began in March 2010. The aim of this program is to advance cutting-edge research projects in various fields and to strengthen Japan's international competitiveness while contributing to society and people's welfare through the application of their results. For the program, thirty core researchers and research topics, which cover a broad area of science and technology, have been selected from ~600 proposals through strong competition. A total of 100 billion Yen is dedicated for promoting the research led by the core researchers. In addition, the FIRST Acceleration Program was additionally implemented using FY 2010 budget (~9.7 billion Yen) in order to strengthen the R&D activities carried out by core researchers on selected topics under the FIRST Program. Outreach activities such as symposiums geared to interested members of the general public are also very much encouraged. Additional funding is also distributed for these activities.

Project Organization

The Core Researcher is Professor Yasuhiko Arakawa, who heads the project. The researchers join PECST from three groups, representing Industry, Academia and Government, where PETRA represents industries, University of Tokyo represents a group of universities, and AIST represents national laboratories. Those researchers cross organizational boundaries to further research into each topic, utilizing the strengths of these different backgrounds.



Core Researcher & Support Organizations

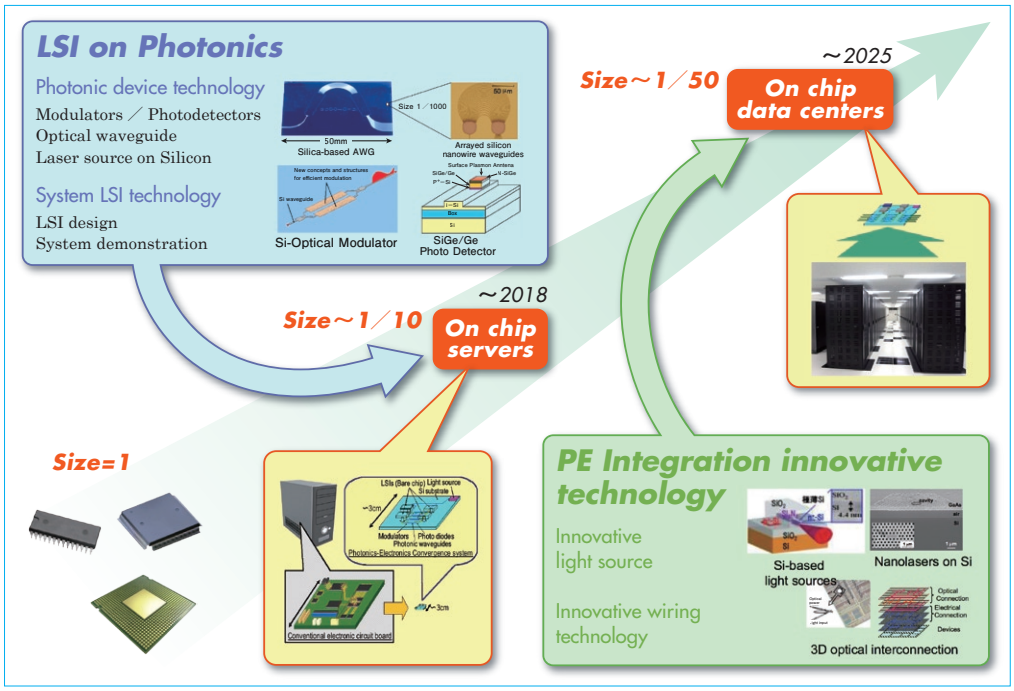
Core Researcher	・Yasuhiko Arakawa, Professor, The University of Tokyo
Co-core Researchers	・Kazumi Wada, Professor, The University of Tokyo ・Takahiro Nakamura, Chief Manager, PETRA
Operational Support Institution	・PETRA (Photonics Electronics Technology Research Association)
Collateral Institutions	・The University of Tokyo ・AIST (National Institute of Advanced Industrial Science and Technology)

Project Outline

In the near future, current computers (more precisely, LSIs in computers) will encounter several challenges such as power minimization, operating speed acceleration, and down-sizing. The convergence between photonics and electronics will create innovative devices and systems to overcome these limitations, and open new directions for research into novel electronic phenomena in semiconductors.

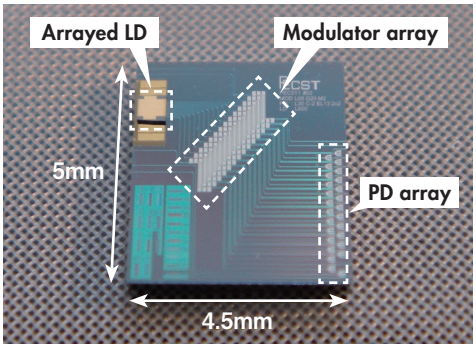
In order to realize Photonics-Electronics convergence systems, it is necessary to not only develop innovative technologies such as silicon light emitters, but also to clear the way to market by demonstration of a system.

This project promotes research and development of these innovative technologies for photonics-electronics convergence in order to realize an "On-chip data Center" – a data center integrated on a chip by 2025.



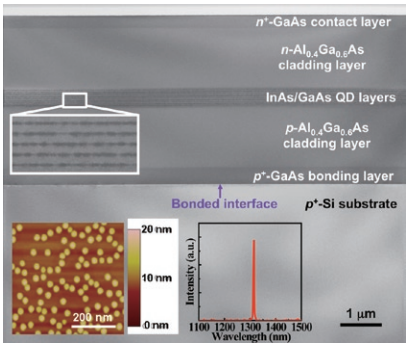
Activity Report 1

We demonstrated, for the first time, optical interconnects integrated with 13-channel array laser, silicon optical modulator and germanium photodetector on a single silicon substrate with 5mm×4.5mm chip size. A 5 Gbps line bit rate and 3.5 Tbps/cm^2 transmission density were achieved. This technology will solve the bandwidth bottleneck among LSI chips in the future.



Activity Report 2

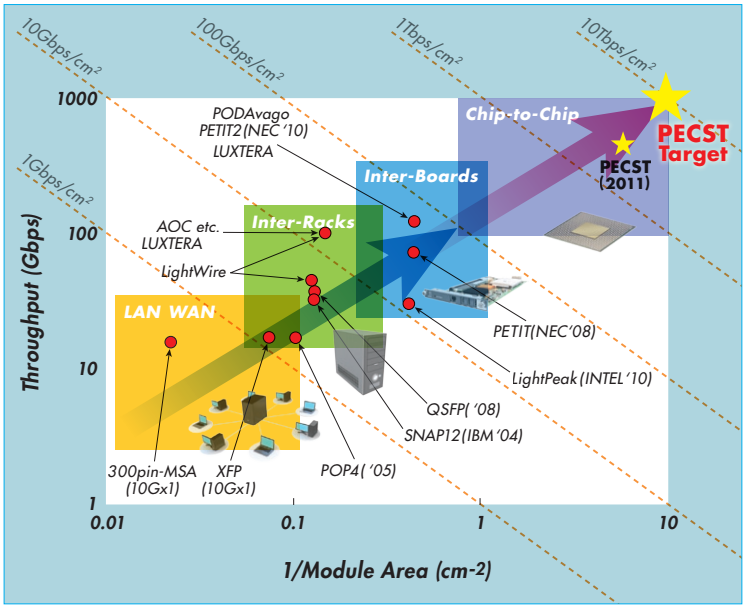
As on-chip light sources, quantum dot lasers have several advantages such as high temperature stability. We have demonstrated InAs/GaAs quantum dot lasers on Si substrates by means of semiconductor wafer bonding and layer transfer. Our laser emits at 1.3 μm with a threshold current density of 205 A/cm^2, the lowest of any kind of laser on silicon reported to date.



Research Goal

In order to overcome the limits of LSI by converging electronics and photonics technologies, the PECST will aim to mount leading-edge LSIs on ultra-dense photonic integrated circuits (10Tbps/cm^2), which we call, "LSI-on-photonics-integration circuits". In addition, we will explore innovative photonic devices based on nanotechnology through strong collaboration between industry and academia.

As a result, the PECST will contribute to develop future technologies for the photonics- electronics convergence system. In all these activities, the PECST will make clear the prospects for industrialization through technological demonstration of photonic integrated circuits, and to develop basic technologies for realizing nanotechnology based innovative systems. Above all, the PECST would like to contribute to the development of a safe, secure and comfortable society, and also contribute to the solution of environment, resource and energy issues, as well as enhance international competitiveness of industry.



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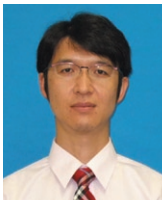

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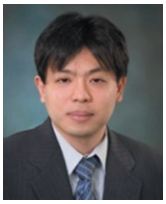

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