

JSPS Core-to-Core Program
FY2011 Implementation Plan (Project No. : 21001)

Research Theme Collaborative Research Center on Ultrahigh-speed Optical Communication

Duration of Project April 1, 2011 – March 31, 2014 (36 months)

Core Institution in Japan (Co-Chair) Research Institute of Electrical Communication,
Tohoku University (Masataka Nakazawa)

Implementing Organizations

○ **Japan**

Japan	Core Institution	Research Institute of Electrical Communication, Tohoku University	
	Co-Chair (name and title)	Masataka Nakazawa, Professor	
	Cooperating Institutions	Graduate School of Engineering, Tohoku University National Institute of Information and Communication Technology National Institute of Advanced Industrial Science and Technology	Number of Cooperating Institutions 3

○ **Partner Countries**

Germany	Core Institution	Heinrich-Hertz Institute	
	Co-Chair (name and title)	Colja Schubert, Group Leader	
	Cooperating Institutions		Number of Cooperating Institutions 0

U.K.	Core Institution	University of Southampton	
	Co-Chair (name and title)	David Richardson, Professor	
	Cooperating Institutions		Number of Cooperating Institutions 0

Denmark	Core Institution	Technical University of Denmark	
	Co-Chair (name and title)	Palle Jeppesen, Professor	
	Cooperating Institutions		Number of Cooperating Institutions 0

Objectives of Research Exchange (including the five years after the project finishes)

The goal of this project is form an international research center on ultrahigh-speed optical communication technologies and realize the world's top-level information and communication infrastructure through the collaborative research and development of 160 Gbit/s~1 Tbit/s optical transmission technologies. A core technology is the time-domain optical Fourier transformation technique that we have developed. By combining it with a highly-functional optical signal processing and high-speed optical devices developed by overseas collaborators, we expect the feasibility of next-generation global large-capacity optical backbone network to be increased.

Results to the present

We successfully demonstrated a 1.28 Tbit/s/ch transmission over 525 km for the first time. In this experiment, ultrafast optical devices developed at HHI, DTU, and ORC played a very important role in allowing us to achieve such an ultrahigh-speed, long-haul transmission. Another important achievement this year was the development of an ultrafast clock recovery circuit capable of operation at 640 Gbit/s that uses a time-domain optical Fourier transformation technique developed at Tohoku University. This experiment was carried out in collaboration with a postdoc from DTU.

We also organized the “International Symposium on Ultra-high Capacity Optical Communication and Related Optical Signal Processing and Devices” on September 16-17, 2010, in Copenhagen, Denmark. The symposium was hosted by DTU and co-organized by Tohoku University and AIST. Twenty-two eminent researchers were invited and eighty researchers from around the world participated. Furthermore, the “Tohoku University Optical Science and Technology Forum” was held. The forum involved thirty photonics professors, and is expected to enhance interdisciplinary collaboration.

Summary of FY 2011 Exchange Plan

Joint Research

Based on the achievements of 1.28 Tbit/s transmission in the previous year, we will demonstrate a long-haul transmission at a bit rate beyond 2 Tbit/s. In addition to the increase in the bit rate with OTDM, we will realize a novel scheme called coherent OTDM RZ/QAM transmission, in which OTDM and multi-level QAM (quadrature amplitude modulation) techniques are combined to achieve both ultrahigh-speed and spectrally-efficient transmission. We will develop key components such as coherent pulse generation and detection, phase synchronization, and digital signal processing at each group, and demonstrate 1 Tbit/s transmission with higher spectral efficiency and lower power consumption.

Seminar

We will organize International Symposium on Ultrafast Photonic Technologies (ISUPT) on September 15-16 in Berlin, Germany, which will be hosted by HHI. The aim is to cover the latest advances not only in ultrahigh-speed communication but also in ultrafast sources, optical metrology and other applications, and discuss ways of pursuing ultimate photonic technologies. In addition ISUPT, “Optical Science Colloquium” and “Optical Science and Technology Forum” will also take place in Tohoku University to strengthen the interactions between different areas of optical sciences.

Researcher Exchanges

We will send more than 20 researchers including students to HHI to participate in ISUPT and to enhance the collaboration with each other by sharing the latest advances at each organization. Leaders of partner groups will periodically meet at international conferences and discuss the future directions of ultrahigh-speed communication technologies.