

JSPS Core-to-Core Program
FY2012 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

Based on the achievement of 1.28 Tbit/s/ch single-polarization DQPSK transmission in 2010, we adopted polarization multiplexing to increase the bit rate to 2.56 Tbit/s/ch, and successfully demonstrated 300 km transmission by employing an ultrafast time-domain optical Fourier transformation technique. Through the experiment, we newly figured out that higher-order polarization-mode dispersion (PMD) leads to a significant performance degradation for ultrashort optical pulses, which grows in proportional to the fourth power of the signal bandwidth.

We also organized International Symposium on Ultrafast Photonic Technologies (ISUPT 2011), which was held in HHI, Berlin on September 15-16, 2011. Twenty-one eminent researchers presented an invited talk, and the number of participants reached 80 from around the world. ISUPT 2011 made a great contribution to stimulate discussion and clarify future perspective in the field of ultrafast photonics, ranging from materials and devices to systems, signal processing, and networking.

Summary of FY 2012 Exchange Plan

Joint Research

We will demonstrate a long-haul transmission at a bit rate beyond 2 Tbit/s over 500 km by using a novel optical pulse called "optical Nyquist pulse", which is newly proposed at Tohoku University last year. We will develop key components for generation, transmission, and detection of optical Nyquist pulses through collaboration with foreign partners. With the optical Nyquist pulses, we aim to realize an ultrahigh-speed transmission with much higher spectral efficiency and lower power consumption compared with conventional schemes.

Seminar

We will organize a domestic symposium on Ultrafast Photonic Technologies on November 5 in Tokyo. The aim is to cover the latest advances not only in ultrahigh-speed transmission but also in different layers, ranging from photonic networking to ultrafast sources, optical metrology, and terahertz waves. In addition, "Optical Science Colloquium" and "Optical Science and Technology Forum" will also continuously 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 accelerate the collaboration through the latest advances at each group. Leaders of partner groups will have an opportunity of in-depth discussion at international conferences and share the future directions of ultrahigh-speed communication technologies.