

## Multiplex transmission of information by electron spin wave

Realization of massive information processing by miniaturizing photoelectric conversion device and reducing electric power consumption

### Overview

Optical fiber has been put into practical use by using the parallelism and multiplexing characteristics of the light as a wave. However, the corresponding photoelectric conversion equipment is required with the increase of the information to be transmitted, resulting in larger device and higher electric power consumption. On the other hand, unlike light, electron cannot incorporate parallelism and multiplexing characteristics, so in principle, electronic device such as semiconductor integrated circuit can not transmit multiple pieces of information simultaneously.

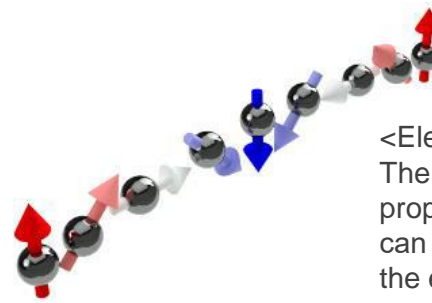
This invention can perform multiplex transmission of information with solid-state electronic device, which has been performed with optical fiber so far, by focusing on "electron spin wave" having wave characteristic, that is to say using its wavelength as information and superimposing electron spin wave on each other. This eliminates the need for sequential calculation when processing multiplex information, and it is expected to replace existing photoelectric conversion device by its miniaturization and electric power consumption reduction, potentially contributing to the vast increase in information processing in the future. Also, the device that collectively transmits, processes and records multi-state information using multiplex electron spin wave could be realized.

### Product Application

- Miniaturization and electric power consumption reduction of existing photoelectric conversion device
- Device that collectively transmits, processes and records multi-state information

### IP Data

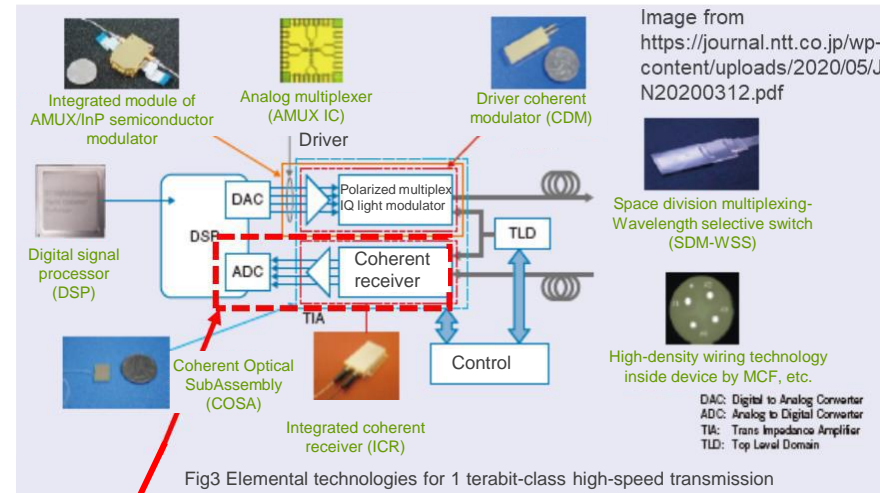
IP No. : ①JP2022-86896 ②PCT/JP2022/018255  
 Inventor : ①KOHDA Makoto, SONEHARA Junpei, IIZASA Daisuke, NITTA Junsaku  
 ②KOHDA Makoto, SEKI Takeshi,  
 UEMURA Tetsuya (Hokkaido Univ.), YUMINAKA Yasushi (Gunma Univ.)  
 Admin No. : ①T20-656 ②T21-213



<Electron spin wave>

The electron spin wave has the wave property, and the length of 1 rotation can be defined as the wavelength  $\lambda$  of the electron spin.

### Effect obtained by the realization of electronic spin wave device



There is a possibility to miniaturize transmitting, processing and recording device down to  $10\mu\text{m}^2$

### Related Works

- M. Kohda and G. Salis, Semiconductor Science and Technology, 32, (2017), 073002.
- D. Iizasa, M. Kohda, U. Zülicke, J. Nitta, M. Kammermeier, Physical Review B, 101, (2020), 245417.

### Contact

Download OnePager



Contact

<https://www.t-technoarch.co.jp/en/contact.html>



Check Out Our Inventions

<https://www.t-technoarch.co.jp/en/anken.php>



Follow us

<https://www.linkedin.com/company/tohoku-techno-arch>



# Leading you to Successful Industrialization



**TOHOKU TECHNO ARCH**

株式会社 東北テクノアーチ