Innovative Wireless Communication Systems through Wireless–Optical Fusion

Principal Investigator：Tetsuya Iizuka （Assoc. Prof., Syst. Design Lab., School of Eng., The Univ. of Tokyo）
Co-PI：Toru Ishihara （Nagoya University）・Akio Higo （The University of Tokyo）

Grand Challenge and Goal： Pioneering the creation of broadband wireless devices that bridge the terahertz gap and achieve unprecedented power performance improvements through the fusion of wireless integrated systems, optical circuit receivers, and optical neural networks

Summary：

- To further improve frequency utilization efficiency, wireless communication technology that leverages the sub-terahertz and terahertz frequency bands is essential
- We aim to pioneer the “terahertz gap” by creating ultra-efficient, broadband wireless communication systems through the fusion of wireless-optical technologies, achieved through cross-disciplinary collaboration among experts in integrated circuits, optical circuits, and optical devices
- We propose a completely new wireless receiver architecture that decodes sub-terahertz waves in the optical analog domain by developing an ultra-energy-efficient optical neural network model that performs inference simply by passing light through it

Social Impact：

- Demonstrating ultra-efficient and broadband wireless devices that bridge the terahertz gap, we aim to realize an advanced digital society that integrates physical and cyber spaces
- Paving the way for the development of wireless devices that achieve ultimate energy efficiency, looking B5G/6G to even the next generation, 7G

Research on optical wireless front-ends (F/E) is becoming increasingly active worldwide ⇒
Seamless optical integration of wireless Rx processing

- An ultra-energy-efficient optical neural network model that performs inference simply by passing light through it
- Proposal of a small-scale inference model suitable for wireless decoding processing as an optical integrated circuit