< Professor Kyoungsik Yu's Lab. >

<Integrated Nanophotonics Laboratory>

■ Contact information

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■ Current state of the Lab. (in 2025 Spring Semester)

PhD Students: 6 Integrated MS-PhD Student: 4 MS Students: 11

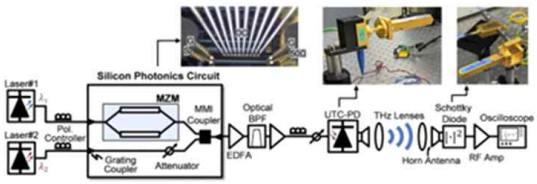
■ Research Areas

The Integrated Nanophotonics Laboratory is working on both fundamental aspects and practical applications of modern photonics / optoelectronics with special emphasis on integration techniques. Especially, we are interested in device-level integration of photonics / optoelectronics for 5G-optical data transmission, advanced information processing, display, smart sensor, and energy applications.

Integrated photonics

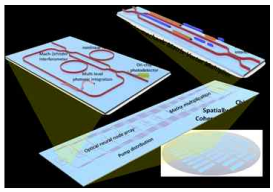
Silicon is the most well known material for electronics, but is also a promising optical medium at near-infrared wavelengths. By taking advantages of advanced fabrication and design techniques developed for electronic circuits, we can now design and build integrated photonic circuits that can complement and sometimes overcome the electronics in a number of cutting-edge applications, such as 'large-scale high-speed interconnects for chiplets', 'optical/wireless communication convergence for beyond 5G, photonic radar and terahertz era', 'high-precision time and frequency reference for quantum sensing', 'energy-efficient optical engines for large-scale information processing and quadratic optimization', and smart sensing – LiDAR (Light Detection And Ranging).

Integrated Photonic circuit



THZ Optical Data Transmission

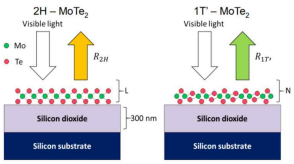
photonic Radar



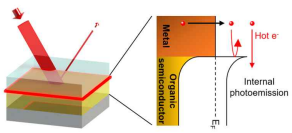
photonic Ising machine

Innovative photonic materials

In addition to conventional group IV semiconductors and III-V compound semiconductor materials, recent innovations in materials research have significantly broadened the scope of modern photonics / optoelectronics. Our group is interested in various emerging materials, such as 2D materials, hybrid materials, and metamaterials.



< 2D phase change material >



< Photodetectors >

■ Recommended courses & Career after graduation

We recommend wave- and device-related courses, such as electromagnetics, semiconductor physics, and optoelectronics. Our alumni members are currently working at universities (**Stanford, UC Berkeley, Toronto, Oxford**), national research institutes (**ETRI, ADD**), and industries (**Samsung, SK Hynix, and PsiQuantum**).

■ Introduction to other activities besides research

We have regular summer and winter retreats, and workshops with domestic & overseas conferences. We also regularly play soccer and badminton. These extracurricular activities are sometimes done with other laboratories with similar research interests.

■ Introduction to the Lab.

Our research group is generally interested in micro-/nano-photonics and optoelectronics, a highly interdisciplinary area with emerging applications in information processing and quantum technologies. Starting from micro-sized optical resonators to subwavelength-scale metamaterials, we cover a wide range of photonic/optoelectronic devices and systems.

■ Recent research achievements

[1] Rah, Yoonhyuk, et al. "Demonstration of spontaneous symmetry breaking in self-modulated ring resonators" Physical Review Research 6.1 **(2024)**

[2] Jin, Yeonghoon, et al. "Rigorous Determination of Dipole Orientation in Organic Thin Films Using Angle-Dependent Photoluminescence." The Journal of Physical Chemistry C 128.4 **(2024).**

[3] Younjae, Jeong et al. "Programmable photonic arrays based on microelectromechanical elements with femtowatt-level standby power consumption." Nature Photonics 17.12 **(2023).**

[4] Son, Gyeongho, et al. "Highly efficient broadband adiabatic mode transformation between single-mode fibers and silicon waveguides." Journal of Lightwave Technology **(2023).**