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국문 강연제목: 의공학 이미징 및 센싱을 위한 메타표면 나노광학

영문 강연제목:

Metasurface nanophotonics for biomedical imaging and sensing

Abstract(영문):

Metasurfaces, composed of planar nanostructure arrays that manipulate phase, amplitude, and polarization, are emerging as compact platforms for highly sensitive, efficient, and high-resolution bioimaging and biosensing. This presentation highlights application-oriented meta-optics for both point spread function (PSF) engineering and molecular detection. In the imaging domain, multifunctional PSFs are demonstrated, including multifocal arrays for super-resolution, needle beams for extended depth of field, and edge-enhanced label-free imaging, thereby enabling faster acquisition and robust feature extraction. In the sensing domain, metasurface nanostructures are utilized to enhance light concentration and spectral selectivity. Representative platforms include fluorescence correlation spectroscopy, surface-enhanced Raman scattering (SERS), and a metaphotonic PCR device, demonstrated for the detection of proteins and DNA. Collectively, these results provide a practical pathway toward multifunctional, high-performance systems and underscore the strong potential of metasurface-based biophotonics in advancing both imaging and sensing technologies.

Brief Biosketch (간단한 이력, 연구/대외활동 소개,국문/영문)

2013-2017	B.S. in Chemical Engineering, Sungkyunkwan University
2017-2021	Ph.D. in Biomedical Engineering, Sungkyunkwan University (Advisor: Myunghwan Choi, Seoul National University)
2021-2023	Postdoctoral researcher in CNIR, Sungkyunkwan University (Advisor: Seong-gi Kim, Sungkyunkwan University)
2023-present	Postdoctoral researcher in IQB, Sungkyunkwan University (Advisor: Inki Kim, Sungkyunkwan University)

[1] Yongjae Jo*, Hyemi Park* et al., "Image scanning microscopy based on multifocal metalens for sub-diffraction-limited imaging of brain organoids" Light: Science & Applications, 2025 (In press)

[2] Yongjae Jo*, Youngjun Kim*, Rian Kang* et al., "Monitoring the Dynamics of Alzheimer's Disease Biomarkers and the APOE-Tau Axis via Human Cerebral Organoids with Immuno-SERS." Advanced science, 2025

[3] Aleksandr Barulin*, Elena Barulina*, Dong Kyo Oh*, Yongjae Jo* et al., "Axially multifocal metalens for 3D volumetric photoacoustic imaging of neuromelanin in live brain organoid", Science Advances, 2025

[4] Yongjae Jo* et al., "Spectral Hadamard microscopy with holographic metasurface" Nanophotonics, 2025