2026 KNOS Winter Workshop on Nano Optics & Related Techniques

제18회 나노광학기술연구회 동계워크샵

The 2026 KNOS Winter Workshop Program

Date: February 25, Wed, 2026	Place: Hotel Tirol 1F, Wilder Kaiser Room
12:00~13:30	Lunch / Registration (Hotel Tirol 1F)
13:30~13:40	Opening Ceremony
13:40~15:00	Poster Session Ⅰ
15:00~15:20	Coffee Break
15:20~16:40	Poster Session Ⅱ
16:40~17:00	Coffee Break
17:00~18:30	Poster Session Ⅲ
18:30~	Dinner

Date: February 26, Thu, 2026	Place: Hotel Tirol 1F, Mozart Room
09:15~09:30	**Plenary session opening remark**
09:30~10:30	**Prof. Satoshi Kawata, University of Osaka and RIKEN** Fluctuation as a Resource in Nanophotonics
10:30~11:00	Coffee break
11:00~11:30	**Prof. Gyeongwon Kang, Kangwon National University** Nanogap-confined Optical Cavities for Studying Dynamics of Surface-bound Molecule
11:30~12:00	**Prof. Kyoung-Duck Park, University of Science and Technology (POSTECH)** Dynamical control of tip-induced light-matter interactions at the nanoscale
12:00~13:30	Lunch
13:30~14:00	**Prof. Hyun Jeong, Daegu University** Advancing Next-Generation Optoelectronics: Harnessing Dark Excitons, Ultrahigh Photosensitivity, and SERS in Atomically Thin 2D Semiconductors
13:30~14:00	**Prof. Myung-Ki Kim, Korea University** Scalable light engineering via metasurface printing
14:30~15:00	Coffee break
15:00~15:30	**Prof. You-Shin No, Konkuk University** Principles of dissipative frictional-transfer microassembly for on-demand reconfigurable and programmable nanophotonic integrations
15:30~16:00	**Prof. Junho Choi, Kyung Hee University** High-field magneto-optical spectroscopy on van der Waals Heterostructures
16:00~16:30	Coffee break
16:30~17:00	**Prof. Soyeong Kwon, Kongju National University** Symmetry Breaking to Control Optical Properties in Van der Waals Materials
17:00~18:00	Sponsor Session
18:10~	Banquet (Hotel Tirol B1F)

Date: February 27, Fri, 2026	Place: Hotel Tirol 1F
~09:10	Breakfast
09:10~10:30	Poster session Ⅳ
10:30~10:50	Coffee Break
10:50~12:00	Committee discussion
12:00~12:10	Closing Ceremony
12:10~	Closing

C·O·N·T·E·N·T·S

Fluctuation as a Resource in Nanophotonics

Satoshi Kawata[1*]

[1] *University of Osaka and RIKEN, Japan*
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In advanced optical technologies, including nano-imaging, nano-sensing, and nano-fabrication, fluctuations in a system have been regarded as a major limitation. They can cause fatal errors in the detection of extremely weak signals and in the fabrication of extremely fine structures, and hence degrade the measurement and fabrication accuracy, as well as spatial and spectral resolution. To suppress such effects, the state-of-the-art instruments rely on ultra–low-noise detectors and electronics, vibration-isolated optical tables, and carefully controlled environments such as dark, clean, vacuum, and cryogenic conditions.

In this presentation, I will discuss an alternative perspective on nanophotonics in which fluctuations are not treated as a source of error or noise, but rather as a valuable resource of nano-photonics. I will demonstrate how this concept enables new functionalities through several examples, including three-dimensional bio-molecular imaging in living cells, laser-scanning confocal Raman microscopy based on stochastic beam fluctuations, and the growth of plasmonic metamaterials with fractal dimensions.

[1] J. Ando, et. al., *Nano Letters* **33**, 5344 (2011).
[2] N. Takeyasu, et al., A*PL Photonics* **1**, 05081 (2016).
[3] S. Kawata, *J. Jpn. Soc. Precision Engineering* **87**, 740 (2021).

Satoshi Kawata

Emeritus Professor, University of Osaka, and Honorary Scientist, RIKEN

Address: Photonics Center, P3-300, University of Osaka, Suita, 565-0871, Japan

• EDUCATION

University of Osaka	Ph. D	Applied Physics	**1979**
University of Osaka	BSc	Applied Physics	**1974**

• PROFESSIONAL ACTIVITIES

- CEO and Representative Director, Nanophoton, Japan (2017-2025)
- Executive Director, Photonics Center, Univ. Osaka (2007-2015)
- Distinguished Professor, University of Osaka (2013-2016)
- Professor, Depts. Applied Physics, Information Sciences, Biosciences. Univ. Osaka (1993- 2017)
- Chief Scientist and Team Leader, Nanophotonics Laboratory, RIKEN (2002-2015)

• PUBLICATIONS

- S. Kawata, “Near Field Optics and Surface Plasmons”, Springer-Verlag(2001)
- S. Kawata and V. Shalaev, “Tip Enhancement”, Elsevier (2007)
- Y. Inouye, S. Kawata, Near-field scanning optical microscope using a metallic probe tip, ***Opt. Lett. 19***, 159–161 (1994)
- S. Kawata, Y. Kawata, Three-Dimensional Optical Data Storage Using Photochromic Materials, ***Chem. Rev., 100,*** 1777-1788 (2000)
- S. Kawata, et. al. Finer features for functional microdevices, ***Nature, 412,*** 697–698 (2001)
- S. Kawata, A. Ono, P. Verma, Subwavelength colour imaging with a metallic nanolens, ***Nature Photonics, 2,*** 438–442 (2008)
- S. Kawata, Y. Inouye, P. Verma, Plasmonics for near-field nano-imaging and superlensing, ***Nature Photonics*, 3**, 388–394 (2009)
- M. Ozaki, J. Kato, S. Kawata, Surface-Plasmon Holography with White-Light Illumination, ***Science 332,*** 218–220 (2011)

• RESEARCH INTERESTS

- Optics, Spectroscopy, Nanoscience, Singal Recovery

• AWARD AND HONORS

- Person of Cultural Merit by Japanese Gov. (2024)
- Medal with Purple Ribbon by the Emperor of Japan (2007)
- **Minister Award, Minister of Education, Science and Technology, Japan (2005)**
- Science Pour L’Art, Vinci d’ Excellence, La Genese des Formes, Louis Vuitton Moét H ennessy (1997)
- Fellows, Optica, SPIE, IOP, JSAP

Nanogap-confined Optical Cavities for Studying Dynamics of Surface-bound Molecules

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Plasmonic nanogaps provide an exceptional platform for creating optical cavities that confine electromagnetic fields to sub-nanometer volumes, enabling ultrasensitive spectroscopy of molecules directly bound to metal surfaces. Despite their promise, achieving controlled cavity formation and selectively probing the dynamics of individual surface-bound species remain significant challenges.

In this presentation, I will introduce nanogap-confined optical cavities based on nanoparticle-on-mirror (NPoM) architectures as a versatile system for studying the real-time behavior of highly polarizable molecules at surfaces. The extreme field confinement within these nanogaps generates strongly enhanced and spatially localized SERS, allowing access to molecular vibrational signatures and symmetry-breaking effects that are typically hidden in ensemble measurements. Using this platform, we directly observe unusual and dynamic spectral behaviors arising from molecule–cavity coupling at the single- or few-molecule level. Furthermore, I will discuss how nanostructure geometry and dimensionality can be engineered to tailor optical cavity formation and stability. By systematically varying the shape and size of plasmonic nanostructures, we construct well-defined single-nanogap cavities that enable controlled interrogation of surface photodynamics. Particular emphasis will be placed on how surface conditions—including molecular adsorption, cleanliness, and interfacial structure—critically influence cavity formation and, consequently, the spectroscopic response.

[1] Kang et al., *Nature Communications* **15**, 9220 (2024).
[2] Lim et al., *manuscript in preparation for submission.*

Gyeongwon Kang

Assistant Professor, Dept. of Chemistry, Kangwon National University.

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● EDUCATION

University of Cambridge	PostDoc	Cavendish Laboratory	**2021-2023**
Northwestern University	Ph.D	Chemistry	**2015-2021**
KAIST	BS	Chemistry	**2009-2015**

● PROFESSIONAL ACTIVITIES

- Committee member, Physical Chemistry Division of Korean Chemical Society (2025-Present)
- Assistant Professor, Dept. of Chemistry, Kangwon National University, Korea (Sep.2023-Present)

● PUBLICATIONS

- "Design rules for Catalysis in Single-particle Plasmonic Nanogap Reactors with Precisely Aligned Molecular Monolayers", *Nat. Commun.*15, 1 (2024)
- "Atomic-Level Insights into Defect-Driven Nitrogen Doping of Reduced Graphene Oxide", *Catalysts,* 14, 4 (2024)
- "Efficient Modeling of Organic Chromophores for Entangled Two-photon Absorption", *J. Am. Chem. Soc.* 142, 23 (2020)
- "Molecular-Scale Mechanistic Investigation of Oxygen Dissociation and Adsorption on Metal Surface-Supported Cobalt Phthalocyanine", *J. Phys. Chem. Lett.* 10, 14 (2019)
- "In Situ Nanoscale Redox Mapping Using Tip-Enhanced Raman Spectroscopy", *Nano Lett.* 19, 3 (2019)

● RESEARCH INTERESTS

- Nanoplasmonics, Enhanced Raman spectroscopy, DFT-based optical modeling

● AWARD AND HONORS

- Graduated with honor, Summa cum laude, KAIST (2015).
- Doctoral study abroad fellowship, Korea Foundation for Advanced Studies (KFAS) (2015-2020).

Dynamical control of tip-induced light-matter interactions at the nanoscale

Kyoung-Duck Park[1*]

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Structure, functions, dynamics, and interactions are the basic properties to systematically understand physical systems existing in nature. In particular, there have been many scientific adventures to understand light-matter interactions, yet in the classical regime at the microscale due to the diffraction-limited optical resolution. Recently, plasmonic nano-cavity enables to induce light-matter interactions and tip-enhanced nano-spectroscopy enables to probe them at the nanoscale. However, these two approaches have developed independently with their own weaknesses so far. In this talk, I provide a novel concept of tip-enhanced cavity-spectroscopy (TECS) overcoming the limitations of previous approaches to induce, probe, and dynamically control ultrastrong light-matter interactions in the quantum tunneling regime. Furthermore, I provide several new directions of nano-spectroscopy and -imaging, which have not been thought in the near-field optics community before. First, we exploit extremely high tip-pressure (~GPa scale) to directly modify the lattice structure and electronic properties of materials. Second, we dynamically control the near-field polarization by adopting adaptive optics technique to near-field optics. Third, we develop conductive TECS to modify electrical properties of materials by directly flowing an electric current through the cavity junction. Furthermore, I will briefly present tip-enhanced effects for single emitters in hBN.

[1] Sujeong Kim et al., *Science Advances* 10, eadr0492 (2024).
[2] Hyeongwoo Lee et al., *Nature Communications* 15, 8725 (2024).
[3] Hyeongwoo Lee et al., *Physical Review Letters* 132, 133001 (2024).
[4] Yeonjeong Koo et al., *Light: Science & Applications* 13, 30 (2024).
[5] Hyeongwoo Lee et al., *Nature Communications* 14, 1891 (2023).
[6] Yeonjeong Koo et al., *Light: Science & Applications* 12, 59 (2023).
[7] Mingu Kang et al., *Nature Communications* 13, 4133 (2022).
[8] Hyeongwoo Lee et al., *Science Advances* 8, eabm5236 (2022).

Kyoung-Duck Park

Associate Professor, Department of Physics, Department of Semiconductor Engineering (JA) Pohang University of Science and Technology (POSTECH)

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EDUCATION

University of Colorado at Boulder	Ph.D	Chemical Physics	**2017**
Inha University, Incheon, Korea	MS	Info. & Commun. Eng.	**2010**
Inha University, Incheon, Korea	BS	Info. & Commun. Eng.	**2008**

PROFESSIONAL ACTIVITIES

- Adjunct Professor, Institute for Convergence Research and Education in Advanced Technology, Yonsei University, **03/2024 ~ current**
- Research Associate, Center for Multidimensional Carbon Materials (CMCM), Institute for Basic Science (IBS), **07/2023 ~ current**
- Assistant Professor, Department of Physics, Pohang University of Science and Technology (POSTECH), **03/2022 ~ 02/2023**
- Assistant Professor, Department of Physics, Ulsan National Institute of Science and Technology (UNIST), **11/2018 ~ 02/2022**
- Postdoctoral Research Associate, Department of Physics, University of Colorado at Boulder, **01/2018 ~ 10/2018**
- Researcher, Sungkyunkwan University (SKKU), **03/2013 ~ 07/2013**
- Researcher, Advanced Photonics Research Institute, GIST, **03/2010 ~ 02/2013**

AWARD AND HONORS

- 2025, Hyundang Physics Award, Korean Physical Society
- 2024, Gyeongbuk Science and Technology Award, Gyeongsangbuk-do, Korea
- 2024, Best Paper Award, The Korean Federation of Science and Technology Societies
- 2022, Ministerial commendation, Ministry of Science and ICT, Korea
- 2022, Young Physicist Award, Korean Physical Society
- 2022, Silver prize, The 28th Samsung Human-Tech Paper Award (Advisor special prize)
- 2020, Young Optical Physicist Award, Korean Physical Society
- 2019, Young Optical Scientist Award, Optical Society of Korea
- 2014, Silver prize, The 20th Samsung Human-Tech Paper Award
- 2022-2025, Samsung Human-Tech Paper Award: group students received awards 5 times over 4 consecutive years (silver 1, bronze 3, honorable 1)

MAIN SCIENTIFIC PUBLICATION

- Hyeongwoo Lee, Huitae Joo, Taeyoung Moon, Yeonjeong Koo, Sujeong Kim, Soo Ho Choi, Uk Jung Kang, Kyung-Hwan Jin, Ki Kang Kim, Deep Jariwala, and **Kyoung-Duck Park**, "Nanoscale Metal–Insulator–Semiconductor Tunnel Junction for Multibit Excitonic Data Storage," ***ACS Nano*** 19, 42489 (2025).
- Yeonjeong Koo, Dong Kyo Oh, Jungho Mun, Artem N. Abramov, Mikhail Tyugaev, Yong Bin Kim, Inki Kim, Tae Ho Kim, Sera Yang, Yeseul Kim, Jonghwan Kim, Vasily Kravtsov, Junsuk Rho, and **Kyoung-Duck Park**, "High momentum two-dimensional propagation of emitted

photoluminescence coupled with surface lattice resonance," ***Light: Science & Applications*** 14, 218 (2025).

- Sujeong Kim, Hyeongwoo Lee, Seonhye Eom, Gangseon Ji, Soo Ho Choi, Huitae Joo, Jinhyuk Bae, Ki Kang Kim, Hyeong-Ryeol Park, and **Kyoung-Duck Park**, "Dynamical control of nanoscale electron density in atomically thin n-type semiconductors via nano-electric pulse generator" ***Science Advances*** 10, eadr0492 (2024).
- Hyeongwoo Lee, Sujeong Kim, Seonhye Eom, Gangseon Ji, Soo Ho Choi, Huitae Joo, Jinhyuk Bae, Ki Kang Kim, Vasily Kravtsov, Hyeong-Ryeol Park, and **Kyoung-Duck Park**, "Quantum tunneling high-speed nano-excitonic modulator" ***Nature Communications*** 15, 8725 (2024).
- Taeyoung Moon, Huitae Joo, Yeonjeong Koo, Mingu Kang, Hyeongwoo Lee, Sunghwan Kim, Cheng Chen, Yung Doug Suh, Dai-Sik Kim, and **Kyoung-Duck Park**, "Adaptive gap-tunable surface-enhanced Raman spectroscopy," ***Nano Letters*** 24, 3777 (2024).
- Hyeongwoo Lee, Benjamin G. Whetten, Byong Jae Kim, Ju Young Woo, Yeonjeong Koo, Jinhyuk Bae, Mingu Kang, Taeyoung Moon, Huitae Joo, Sohee Jeong, Jaehoon Lim, Alexander L. Efros, Markus B. Raschke, Matthew Pelton, and **Kyoung-Duck Park**, "Electrically Tunable Single Polaritonic Quantum Dot at Room Temperature," ***Physical Review Letters*** 132, 133001 (2024).
- Yeonjeong Koo, Taeyoung Moon, Mingu Kang, Huitae Joo, Changjoo Lee, Hyeongwoo Lee, Vasily Kravtsov, and **Kyoung-Duck Park**, "Dynamical control of nanoscale light-matter interactions in low-dimensional quantum materials," ***Light: Science & Applications*** 13, 30 (2024).
- Mingu Kang, Su Jin Kim, Huitae Joo, Yeonjeong Koo, Hyeongwoo Lee, Hyun Seok Lee, Yung Doug Suh, and **Kyoung-Duck Park**, "Nanoscale manipulation of exciton-trion interconversion in a $MoSe_2$ monolayer via tip-enhanced cavity-spectroscopy," ***Nano Letters*** 24, 279 (2024).
- Hyeongwoo Lee, Yong Bin Kim, Jae Won Ryu, Sujeong Kim, Jinhyuk Bae, Yeonjeong Koo, Donghoon Jang, and **Kyoung-Duck Park**, "Recent progress of exciton transport in two-dimensional semiconductors," ***Nano Conversions*** 10, 57 (2023).
- Hyeongwoo Lee, Yeonjeong Koo, Shailabh Kumar, Yunjo Jeong, Dong Gwon Heo, Soo Ho Choi, Huitae Joo, Mingu Kang, Radwanul Hasan Siddique, Ki Kang Kim, Hong Seok Lee, Sangmin An, Hyuck Choo, and **Kyoung-Duck Park**, "All-optical control of high-purity trions in nanoscale waveguide," ***Nature Communications*** 14, 1891 (2023).
- Yeonjeong Koo, Hyeongwoo Lee, Tatiana Ivanova, Roman Savelev, Mihail Petrov, Vasily Kravtsov, and **Kyoung-Duck Park**, "Nanocavity-integrated van der Waals heterobilayers for nano-excitonic transistor," ***ACS Nano*** 17, 4584 (2023).
- Yeonjeong Koo, Hyeongwoo Lee, Tatiana Ivanova, Ali Kefayati, Vasili Perebeinos, Ekaterina Khestanova, Vasily Kravtsov, and **Kyoung-Duck Park**, "Tunable interlayer excitons and switchable interlayer trions via dynamic near-field cavity," ***Light: Science & Applications*** 12, 59 (2023).
- Mingu Kang, Hyunwoo Kim, Elham Oleiki, Yeonjeong Koo, Hyeongwoo Lee, Taeyong Eom, Geunsik Lee, Yung Doug Suh, and **Kyoung-Duck Park**, "Conformational heterogeneity of molecules physisorbed on a gold surface at room temperature," ***Nature Communications*** 13, 4133 (2022).
- Hyeongwoo Lee, Yeonjeong Koo, Jinseong Choi, Shailabh Kumar, Hyoung-Taek Lee, Gangseon Ji, Soo Ho Choi, Mingu Kang, Ki Kang Kim, Hyeong-Ryeol Park, Hyuck Choo, and **Kyoung-Duck Park**, "Drift-dominant exciton funneling and trion conversion in 2D semiconductors on the nanogap," ***Science Advances*** 8, eabm5236 (2022).
- Hyeongwoo Lee, Ju Young Woo, Dae Young Park, Inho Jo, Jusun Park, Yeunhee Lee, Yeonjeong Koo, Jinseong Choi, Hyojung Kim, Yong-Hyun Kim, Mun Seok Jeong, Sohee Jeong, and **Kyoung-Duck Park**, "Tip-induced strain engineering of a single metal halide perovskite quantum dot," ***ACS Nano*** 15, 9057 (2021).
- Hyeongwoo Lee, Inki Kim, Chulho Park, Jinseong Choi, Mingu Kang, Jungho Mun, Yesul Kim, Jeong Hoon Park, Markus B. Raschke, Mun Seok Jeong, Jun Suk Rho, and **Kyoung-Duck Park**, "Inducing and probing the localized excitons in atomically thin semiconductors via tip-enhanced

cavity-spectroscopy," ***Advanced Functional Materials*** 31, 2102893 (2021) [Frontispiece].

- Dong Yun Lee, Chulho Park, Jinseong Choi, Yeonjeong Koo, Mingu Kang, Mun Seok Jeong, Markus B. Raschke, and **Kyoung-Duck Park**, "Adaptive tip-enhanced nano-spectroscopy," ***Nature Communications*** 12, 3465 (2021).
- Yeonjeong Koo, Yongchul Kim, Soo Ho Choi, Hyeongwoo Lee, Jinseong Choi, Dong Yun Lee, Mingu Kang, Hyun Seok Lee, Ki Kang Kim, Geunsik Lee, and **Kyoung-Duck Park** "Tip-induced nano-engineering of strain, bandgap, and exciton funneling in 2D semiconductors" ***Advanced Materials*** 33, 2008234 (2021) [Front cover].
- See https://scholar.google.com/citations?user=VrVZPLgAAAAJ&hl=en for full publications
- **PATENT** applied/registered >45

Advancing Next-Generation Optoelectronics: Harnessing Dark Excitons, Ultrahigh Photosensitivity, and SERS in Atomically Thin 2D Semiconductors

Hyun Jeong[1*]

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This study provides a comprehensive investigation into the transformative potential of two-dimensional (2D) materials for the advancement of next-generation semiconductor technologies. As conventional three-dimensional (3D) crystalline semiconductors approach their physical scaling limits, they suffer from a significant reduction in carrier mobility at ultra-thin dimensions. In contrast, 2D semiconductors maintain high carrier mobility even at thicknesses below one nanometer, offering a critical solution to the challenges of miniaturization. To bridge the gap between theoretical potential and practical application, this research explores three key functional domains. First, the study elucidates the mechanism behind large-area bright emission from plasmon-coupled dark excitons. By effectively manipulating these typically non-radiative states, we demonstrate the potential for 2D materials to serve as the foundation for highly efficient, ultra-thin light sources. Building on these optical insights, the research moves to the development of ultrahigh photosensitivity platforms using freestanding transition metal dichalcogenides (TMDs). By isolating these materials from substrate interference, we showcase how their unique electrical properties can be leveraged to create high-performance sensors for next-generation detection technologies. Finally, the research proposes a specialized platform for surface-enhanced Raman scattering (SERS) within layered materials. This investigation highlights how the precise structural properties of 2D lattices can enhance the sensitivity of biochemical analysis, providing a new frontier for molecular diagnostics. Taken together, these findings provide a fundamental framework for understanding the diverse application possibilities of 2D semiconductors. The results suggest that the strategic utilization of these materials will play a pivotal role in driving the evolution of the semiconductor industry, enabling the creation of devices that are not only smaller but also possess unprecedented functional capabilities.

[1] Hyun Jeong et al., *Science Advances* **12**, 2411841 (2025).
[2] Hyun Jeong et al., *ACS Nano* **18**, 4432 (2024).
[3] Hyun Jeong et al., *Applied Surface Science* **646**, 158823 (2024)

Hyun Jeong

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● EDUCATION

France Univ. Tech. Troyes	PostDoc	Low-dimensional materials	**14-17**
Jeonbuk National University	Ph.D	Semiconductor Engineering	**2012**
Jeonbuk National University	MS	Semiconductor Engineering	**2008**
Jeonbuk National University	BS	Semiconductor Physics	**2006**

● PROFESSIONAL ACTIVITIES

- Postdoc., Adv. Photon. Research Institute (APRI), GIST, Korea (Mar.2012 – Feb.2013)
- Postdoc., CINAP, IBS, Sungkyunkwan Univ., Korea (Mar.2013 – Aug.2014)
- Postdoc., CNRS, LNIO, Univ. of Tech. of Troyes, France (Sep.2014 – Feb.2017)
- Postdoc., Nano Systems Research Division, KIMM, Korea (Mar.2017 – Jun.2018)
- Principal engineer, OLED Light, EXO Team, LG Display, Korea (Jun.2018 – Feb.2022)
- Research Professor, Dept. of Physics, Hanyang University, Korea (Mar.2022 – Feb.2025)
- Assistant Professor, Dept. of Semicond. Electron. Eng., Daegu Univ. (Mar.2025-Present)
- Director of Semiconductor Bootcamp, Daegu Univ., Korea (Sep.2025-Present)

● PUBLICATIONS

- “Integrated Freestanding Two-dimensional Transition Metal Dichalcogenides” *Advanced Materials,* **29**, 1700308 (2017) *cited > 45 times.*
- "Semiconductor-Insulator-Semiconductor Diode Consisting of Monolayer MoS_2, h-BN, and GaN Heterostructure" *ACS Nano* **9**, 10032 (2015) *cited > 126 times.*
- “Metal-Insulator-Semiconductor Diode Consisting of Two-Dimensional Nanomaterials” *Nano Letters* **16**, 1858 (2016) *cited > 105 times.*
- “Ultrahigh Photosensitivity Based on Single-Step Lay-on Integration of Freestanding Two-Dimensional Transition-Metal Dichalcogenide” *ACS Nano* **18**, 4432 (2024) *cited > 3 times.*
- “Large-area bright emission of plasmon-coupled dark excitons at room temperature” *Advanced Science* **12**, 2411841 (2025) *cited > 6 times.*

● RESEARCH INTERESTS

- Low-Dimensional Materials and Devices (Diodes, FETs)
- Photodetectors and LEDs
- PL and Raman spectroscopy

● AWARD AND HONORS

- Best presentation award, Korean Society of Mechanical Engineers (2018)

Scalable light engineering via metasurface printing

Myung-Ki Kim[1*]

[1]*KU-KIST Graduate School of Converging Science and Technology, Korea University, Seoul 02841, Republic of Korea*
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Scalable and deterministic control of light–matter interaction is a central challenge in advancing compact photonic and quantum optical systems. In particular, bridging disparate platforms—such as optical fibers, micro- and nano-scale lasers, and solid-state quantum emitters—requires an integration strategy that is both flexible and scalable. In this work, we present metasurface printing as a versatile and unifying approach for scalable light engineering across multiple photonic architectures. By leveraging transfer-based printing techniques, metasurfaces are deterministically integrated onto unconventional and previously inaccessible platforms, enabling precise control of emission directionality, wavefront shaping, and photon extraction without redesigning the underlying light sources. We first demonstrate metasurface-on-fiber architectures that realize multilayer wavefront engineering and efficient beam shaping in fiber-integrated systems [1]. We then extend this approach to emission engineering of microdisk lasers via printed meta-micromirrors, achieving enhanced vertical extraction and improved compatibility with low-numerical-aperture optics [2]. Finally, we introduce defect-selective metalens printing for quantum emitters, enabling high-purity single-photon extraction from diamond nitrogen-vacancy centers under ultra-low-NA conditions [3]. Together, these results establish metasurface printing as a scalable light engineering platform that connects fiber optics, on-chip lasers, and quantum-grade photonic sources, providing a pathway toward plug-and-play photonic and quantum optical systems.

[1] M. Kim et al., *Nanophotonics* **12**, 2359 (2023).
[2] A. Yu et al., *Nanophotonics* **13**, 2903 (2024).
[3] M. Jeon et al., *Small* **21**, e10745 (2025).

MYUNG-Ki KIM

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• EDUCATION

Caltech	PostDoc	Electrical Engineering	**12–14**
UC Berkeley	PostDoc	Electrical Engineering	**09–12**
KAIST	Ph.D	Physics	**2009**
Korea University	BS	Physics	**2004**

• PROFESSIONAL ACTIVITIES

- Professor, KU-KIST Graduate School of Converging Science & Technology, Korea University (Mar. 2023 – Present)
- Associate Chair, Department of Integrative Energy Engineering, College of Engineering, Korea University (Mar. 2025 – Present)
- Adjunct Professor, Dept. of Integrative Energy Engineering, College of Engineering, Korea University (Sep. 2020 – Present)
- Director, K^2 Convergence Joint Facility Center (Jun. 2023 – Jan. 2026)
- Associate Professor, KU-KIST Graduate School of Converging Science & Technology, Korea University (Mar. 2018 – Feb. 2023)
- Visiting Professor, Dept. of Electrical Engineering and Computer Sciences, UC Berkeley, USA (Feb. 2022 – Jan. 2023)
- Vice Director, Center for Bio-innovative Advanced Materials, Korea University (Sep. 2020 – Feb. 2022)
- Assistant Professor, KU-KIST Graduate School of Converging Science & Technology, Korea University (Sep. 2015 – Feb. 2018

• PUBLICATIONS

- "Electromagnetic interference shielding using metal and MXene thin films", *Nature.* **647**, 356 (2025)
- "Ultrahigh nonlinear responses from MXene plasmons in the short-wave infrared range", *Adv. Mater.* **36**, 2309189 (2024)
- "Light Engineering in Nanometer Space", *Adv. Mater.* **32**, 2003051 (2020)
- “Anomalous absorption of electromagnetic waves by 2D transition metal carbonitride Ti_3CNT_x (MXene)”, *Science* **369**, 446 (2020).
- “Near-field transmission matrix microscopy for mapping high-order eigenmodes of subwavelength nanostructures”, *Nature* Comm. **11**, 2575 (2020)

• RESEARCH INTERESTS

- Nanophotonics, Plasmonics, Silicon Photonics, Metasurfaces, Quantum Optics

• AWARD AND HONORS

- The Hall of Fame (Outstanding Researcher) at Korea University (2023).
- KU Internationalization Award (KU Pagoda Award) (2023)
- Outstanding Research Innovation Award (KoNTRS) (2021)

Principles of dissipative frictional-transfer microassembly for on-demand reconfigurable and programmable nanophotonic integrations

You-Shin No[1*]

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Despite the notable advancements achieved through conventional and cutting-edge strategies, integration technologies utilizing the micro-transfer-printing technique – employing microstructured polymeric stamps, such as polydimethylsiloxane (PDMS) – have garnered considerable attention. This innovative approach facilitates heterogeneous integration by enabling the deterministic placement of micro- and nanoscale optical structures and materials with sub-micrometer alignment onto diverse photonic integration platforms [1–4]. In this talk, we discuss fundamental principles of this integration technology, primarily focusing on the dissipative friction energy during the process, which enables on-demand and high-precision transfer-dragging-assisted microassembly. The frictional dragging method thus allows for the development of reconfigurable/programmable and heterogeneous nanophotonic integrations, which are the previously challenging and impossible to achieve with conventional strategies.

[1] S.-W. Park et al., *ACS Photon.* **7**, 3313-3320 (2020).

[2] M.-W. Kim et al., *Nano Lett.* **22**, 1316-1323 (2022).

[3] B.-J. Min et al., *Appl. Phys. Lett.* **121**, 21107 (2022).

[4] B.J. Park et al., *Sci. Adv.* **10**, 38, eadl1548 (2024).

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• EDUCATION

Harvard University	PostDoc	Chemistry & Chem. Biology	**2017**
Korea University	Ph.D	Physics	**2014**
Korea University	MS	Physics	**2010**
Korea University	BS	Physics	**2008**

• PROFESSIONAL ACTIVITIES

- Assistant Professor, Dept. of Physics, Konkuk University, Korea (Mar.2017-Fab.2020)
- Associate Professor, Dept. of Physics, Konkuk University, Korea (Mar.2020-Present)

• PUBLICATIONS

- Hyundong Kim†, Dongmin Shin†, Gon Young Bae, Gil-Woo Lee, Hae Young Jung, Jae-Pil So*, Myung-Ki Kim* and **You-Shin No*** and Myung-Ki Kim*, "Recent progress in on-demand transfer-enabled integration of wavelength-scale light sources", ***Nanophoton.*** ***Under review***
- Byung Jun Park†, Min-Woo Kim†, Kyong-Tae Park, Hwi-Min Kim, Byeong Uk You, Aran Yu, Jin Tae Kim, **You-Shin No*** and Myung-Ki Kim*, "Minimal-gain-printed silicon nanolaser", ***Sci. Adv.*** **10**, eadl1548 (2024).
- Kyong-Tae Park†, Kyong-Ho Kim†, Byung-Ju Min, **You-Shin No***, "Normal mode analysis in multi-coupled non-Hermitian optical nanocavities", ***Sci. Rep.*** **13**, 17510 (2023).
- Min-Woo Kim†, Sun-Wook Park†, Kyong-Tae Park†, Byung-Ju Min†, Ja-Hyun Ku, Jin-Yong Ko, Jin Sik Choi, **You-Shin No***, "All-graphene-contact electrically pumped on-demand transferrable nanowire source", ***Nano Lett.*** **22**, 1316-1323 (2022).
- Sun-Wook Park†, Min-Woo Kim†, Kyong-Tae Park†, Ja-Hyun Ku, and **You-Shin No***, "On-Chip Transferrable Microdisk Lasers", ***ACS Photon.*** **7**, 3313−3320 (2020)

• RESEARCH INTERESTS

- Photonic key elements and large-area integrated photonic circuits (PICs) and systems
- Heterogeneous/hybrid 3D vertical integration and manipulation technologies
- High-quality light sources at nanoscale (e.g., nanolasers, nanoLEDs, nano-emitters, etc.)
- Non-Hermitian topological photonics (cavities, waveguides and lasers)
- Silicon carbide (SiC) based quantum emitters and integrated quantum photonics

High-field magneto-optical spectroscopy on van der Waals Heterostructures

Junho Choi[1*]

[1] *Department of Physics, Kyung Hee University, Seoul 02447, Republic of Korea*
*E-mail: junhochoi@khu.ac.kr

This presentation highlights recent magneto-optical investigations carried out in pulsed high magnetic fields exceeding 55 Tesla, aimed at exploring emergent many-body phenomena in van der Waals (vdW) semiconductors and magnets. Magneto-optical spectroscopy has long been a versatile and powerful approach for extracting key semiconductor properties [1–4]. For two-dimensional materials such as MoS_2 and WSe_2, their unusually large exciton binding energies and heavy carrier effective masses require access to ultrahigh magnetic fields in order to reveal intrinsic electronic and excitonic characteristics. In vdW magnetic systems, high-field spectroscopy provides a direct window into spin-dependent excitonic responses, including localization–delocalization behavior and magnetization-driven optical anisotropy. We report our recent progress in using ultrahigh-field magneto-optical spectroscopy to uncover many-body and spin-related excitonic effects in these vdW heterostructures.

[1] Choi *et al*., Physical Review B **109**, L041304 (2024).
[2] Li *et al*., Nano Letters **22**, 426-432 (2022).
[3] Li *et al*., Physical Review Letters **125**, 147602 (2020).
[4] Stier *et al*., Nature Communications **7**, 10643 (2016).

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● EDUCATION

University of Texas at Austin	Ph.D	Physics	**2020**
Kyung Hee University	MS	Physics	**2014**
Kyung Hee University	BS	Physics	**2012**

● PROFESSIONAL ACTIVITIES

- Assistant Professor, Department of Physics, Kyung Hee University, Seoul, Republic of Korea, (Mar.2024 – Present)
- Senior Research Scientist, Korea Research Institute of Standards and Science, Daejeon, Republic of Korea, (Dec.2022 – Feb.2024)
- Director's Postdoctoral Fellow, National High Magnetic Field Laboratory, Los Alamos National Laboratory, Los Alamos, NM, USA (Sep.2020 – Nov.2022)

● PUBLICATIONS

- "Emergence of composite many-body exciton states in WS_2 and $MoSe_2$ monolayers." *Physical Review B* **109**, L041304 (2024)
- "Asymmetric magnetic proximity interactions in $MoSe_2/CrBr_3$ van der Waals heterostructures." *Nature Materials* **22**, 305-310 (2023)
- "Fermi-Pressure and Coulomb Repulsion Driven Rapid Hot Plasma Expansion in a van der Waals heterostructure." *Nano Letters* **23**, 4399-4405 (2023)
- "Twist angle dependent interlayer exciton lifetimes in van der Waals heterostructures," *Physical Review Letters* **126**, 047401 (2021)
- "Moiré Potential Impedes Interlayer Excitons Diffusion in Van Der Waals Heterostructures," *Science Advances* **6**, eaba8866 (2020)

● RESEARCH INTERESTS

- Magneto-optical spectroscopic studies on van der Waals materials
- High magnetic field (B>60T) study on van der Waals materials
- Ultrafast dynamics of many-body states
- Spectroscopic ellipsometry

● AWARD AND HONORS

- Young Semiconductor Physicist Award, Korean Physical Society, Republic of Korea (2024)
- Director's Postdoctoral Fellowship, Los Alamos National Laboratory, USA (2021)

Symmetry Breaking to Control Optical Properties in Van der Waals Materials

Soyeong Kwon[1*]

[1] *Department of Optical Engineering, Kongju National University, Cheonan 31080, Republic of Korea*
*E-mail: soyeongk@kongju.ac.kr

Symmetry plays a fundamental role in determining the inherent stability of material systems. However, deliberate symmetry breaking can serve as a powerful strategy to engineer various physical properties. In this talk, I will discuss symmetry breaking in van der Waals (vdW) materials, which consist of atomically thin (~10^{-9} m scale) layers. Their extreme thinness gives rise to unique mechanical flexibility, environmental tunability, and novel optical properties. The first part of the talk will focus on a direct approach to breaking the hexagonal symmetry of vdW materials via mechanical strain, enabling directional control over their optical response[1]. In the second part, I will introduce an indirect method to break symmetry by integrating symmetric vdW materials with intrinsically low-symmetry layers, further modulating their optical behavior through dielectric environment engineering[2]. These two approaches provide a framework for controlling light-matter interactions in 2D materials, and open pathways toward next-generation flexible optoelectronics and quantum photonic applications.

[1] *Nature Communications* **15**, 10847 (2024).
[2] *Nanophotonics* **14**, 10 (2025).

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● EDUCATION

UC Irvine	PostDoc	Mechanical&Aerospace Engineering	**2023-5**
Ewha Womans University	Ph.D	Applied Physics	**2022**
Ewha Womans University	MS	Physics	**2019**
Ewha Womans University	BS	Physics	**2017**

● PROFESSIONAL ACTIVITIES

- Assistant Professor, Department of Optical Engineering, Kongju National University, Korea (2025–Present)
- UC Irvine Chancellor's Postdoctoral Fellow (PPFP), Multifunctional Materials and Mechanics Group, University of California, Irvine, U.S.A. (2023–2025)
- Postdoctoral Researcher, New and Renewable Energy Research Center, Ewha Womans University, Korea (2022–2023)

● PUBLICATIONS

- "Strained two-dimensional tungsten diselenide for mechanically tunable exciton transport," *Nature Communications* **15**, 10847 (2024).
- "Harnessing in-plane optical anisotropy in WS_2 through ReS_2 crystal," *Nanophotonics* **14**, 1553–1561 (2025).
- "Nano-optical metrologies for characterizing the carrier dynamics in two-dimensional materials," *Materials Research Bulletin* **187**, 113382 (2025).
- "Exciton transfer at heterointerfaces of MoS_2 monolayers and fluorescent molecular aggregates," *Advanced Science* **9**, 2201875 (2022).

● RESEARCH INTERESTS

- Strain mechanics and exciton dynamics in low-dimensional van der Waals materials
- Nanoscale optical characterization using spectroscopy and AFM-based near-field microscopy

● AWARD AND HONORS

- UKC Poster Award (MSE), Korean-American Scientists and Engineers Association (2025)
- Excellent Dissertation Award, Ewha Womans University (2022)
- Best Oral Presentation Award, Korean Physical Society (Spring & Fall Meetings, 2019–2020)
- Best Poster Presentation Award, Korean Vacuum Society & ICAMD (2018–2019)

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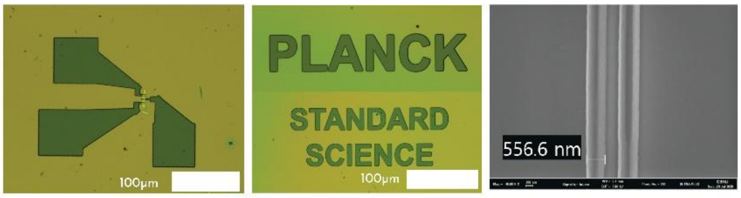

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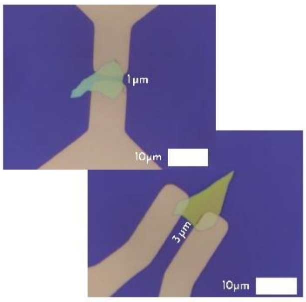

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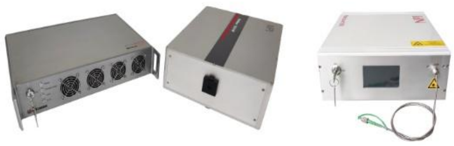

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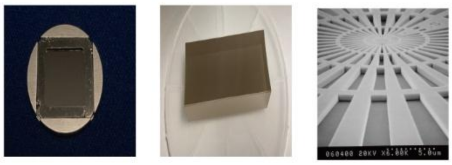
532nm/ 780nm/ 1030nm / 1550nm/ 2000nm

XUV/EUV X-ray Optics

NTT AT



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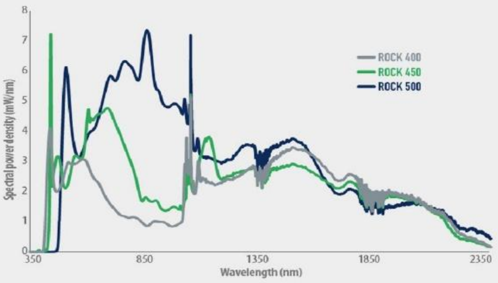

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OPTICAL TABLE (광학테이블)

정밀제진 SYSTEM 에스엠텍이 함께 하겠습니다.

OVERHEAD TABLE SHELF SYSTEM

- 작업공간 절약
- 분리하여 운반, 설치
- 전원사용 편리 (220V/110V)
- 차단기 내장하여 과부하시 자동 전원차단
- 계측기류 선반에 배치 가능

KS Q ISO 9001
KS I ISO 14001

국내 최초

허니콤브레드보드 12.5mm 홀가공 제작

- 탁월한 감쇠효과
- 자동수평유지
- 전방향 제진능력

(주)에스엠텍 직접제조!
고객요구사항에 따른 모든제품 주문제작!

OPTICAL TABLE / BREADBOARD

- 질량은 낮고 강성은 우수한 하니콤 구조로 제작하였고, Magnetic Stainless 강판에 M6-25의 탭이 있어 광학부품을 고정하기가 용이합니다.
- 두께 50mm, 100mm, 200mm, 300mm의 선택으로 Application의 성능을 최대한 발휘할 수 있도록 선택하여 사용할수 있습니다.
- 공기스프링식 지지대 (Pneumatic Support)
  - 전방향의 제진 기능이 있으며, 감쇠효과가 뛰어난 제진장치로 신속한 반응으로 제진 성능을 발휘합니다.

SOLID ALUMINUM BREADBOARD

- 고객요구에 따라 다양한 형상 제작 가능
- Honeycomb Breadboard에 비해 가벼우므로 운반 및 취급 용이
- M6-25 탭홀 제작
- 재질 : 알루미늄
- M6 Counter Bore 가공이 가능하여 프레임에 고정 가능

DESKTYPE BIO WORKSTATION

- Patch Clamp
- Cell Injection
- Confocal Microscope
- Live Cell Microscopy
- 기타 생리학 실험 및 생물 현미경

DESKTYPE WORKSTATION / CLEAN WORKSTATION

- 금속현미경
- 광학현미경
- Microscope
- 형상측정기
- Probe Station
- Profiler
- 비전 장치
- Wafer Probe Station
- Mask Aligner
- 표면 조도계
- 3D Profiler
- 기타 반도체 정밀장비

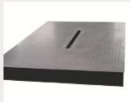
DESKTYPE ISOLATION TABLE

- 광학현미경
- 전자저울
- 표면조도계
- 기타 소형 정밀 측정기기
- 탁상형 제진대로서 박형설계에 의해 이동성이 용이합니다.
- 제진 상판은 Aluminum Breadboard 를 사용하여 M6-25mm의 Tap을 편리하게 이용하실 수 있습니다.
- 특수 소형 Isolator에 의해 진동이 제진성능이 뛰어나고, 가볍게 설계되었습니다.
- Auto Level Control을 사용, 빠른 복원력을 갖추고 있습니다.

CLEANBOOTH

- AL Profile의 구조물로 가볍고 견고하게 구성되며, 사이즈에 따라 선정하여 쉽게 조립할 수 있습니다.
- Hepa Filter의 부착으로 청정도 Class 100~10,000 Zone (/ft3)을 유지할 수 있습니다.
- Door의 종류로는 Zipper, Strip, Fold Door 중 선택할 수 있습니다.
- 무정전 비닐의 사용으로 작업공간의 Particle 제거 및 정전기 방지 기능이 있습니다.
- 정화된 공기의 흐름이 내부에서 외부로 양압이 발생하므로 이물질 유입이 방지됩니다.
- 풍량 조절 스위치로 간단히 풍량을 조절할 수 있습니다.

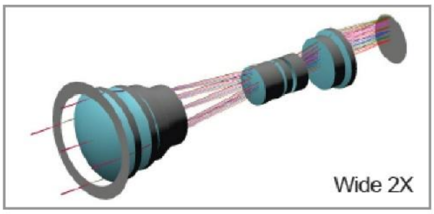


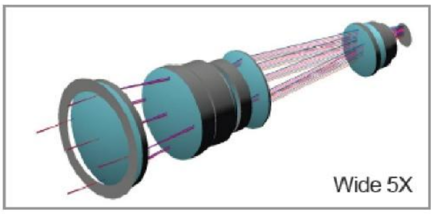



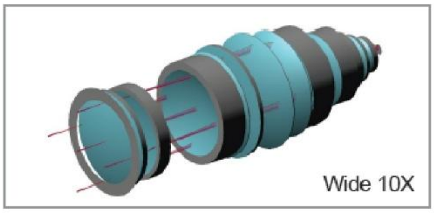


Specifications

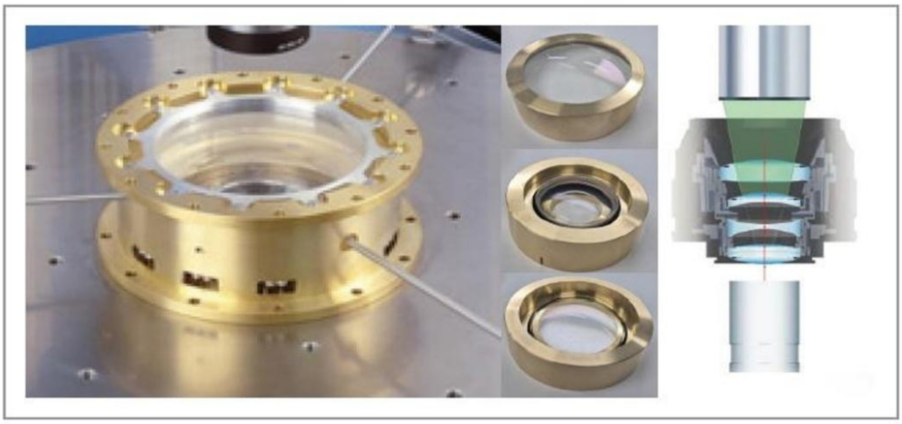
Main specifications	High NA 20X	Wide 10X	Wide 5X	Wide 2X	Super Wide 10X	DUV 20X
NA	0.6	0.4	0.2	0.08	0.4	0.6
Effective focal length	10mm	75mm	150mm	375mm	75mm	10mm
Wavelength	450nm ~ 650nm	450nm ~ 650nm	450nm ~ 650nm	450nm ~ 651nm	450nm ~ 650nm	266nm
RMS wavefront Error	1/8 λ	1/16 λ	1/16 λ	1/16 λ	1/16 λ	1/10 λ
resolution	0.6um	1.0um	1.8um	5.0um	1.0um	0.3um
투과율 (1면당)	99.50%	99.50%	99.50%	99.50%	99.50%	99.50%
FOV	1.2mm	6.4mm	12.8mm	31.6mm	8.3mm	2.3mm
Working distance	3.0mm	13.7mm	14.0mm	28.0mm	13.7mm	3.0mm
Distortion	0.30%	0.05%	0.05%	0.06%	0.05%	0.10%
lens length	120mm	230mm	230mm	230mm	238mm	100mm

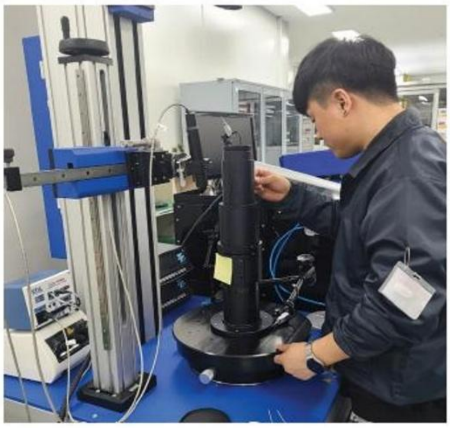

Wide 2X


Wide 5X

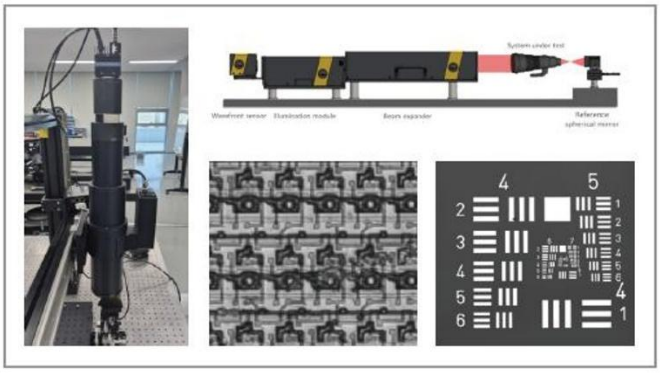

Wide 10X

Zero-Decenter Optical Assembly





Lens Evaluation - RMS WFE / MTF




RMS wavefront Error
(Double pass method)

ISO 9001 14001 2015

LRQA CERTIFIED AS 9100

KAB KAB-AS-03

For any further inquiry : korsales@keoc.kr

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