

# Sergey G. Menabde, Ph.D.

Research Professor

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## Research activity

Recent research projects as Principle Investigator:

1. Image polaritons for ultra-compact optoelectronic devices; funded by Korean government.
2. Electrically tunable plasmonic crystal based on 2D materials; funded by Korean government.

Research activity over the past few years: graphene photonics and plasmonics, photodoping of graphene, physics of hot carriers in graphene/graphite and its application for photodetection.

Other research experience: light sail design, numerical optimization methods in photonics, plasmonic waveguides, lens systems design and optimization.

## Education

- ❖ Ph.D. (2012-2017), Seoul National University, major in electrical engineering, minor in nanophotonics.  
Thesis title: "One-dimensional transverse magnetic and unique transverse electric modes in graphene."
- ❖ M.Sc. (2007-2009), Seoul National University, major in electrical engineering.  
Thesis title: "Photonic crystal waveguide optimization for directional emission effect."
- ❖ B.Sc. & M.Sc. (2001-2007), Bauman Moscow State Technical University, major in optoelectronics and optical engineering (Diploma Cum Laude).  
Thesis title: "Initial schemes design for a compact zoom lens with large zoom ratio."

## Work experience

- ❖ 03.2021 - present: Research Assistant Professor, KAIST
- ❖ 10.2017 - 02.2021 (3 years 4 months): Postdoctoral Fellow, KAIST
- ❖ 09.2009 - 07.2012 (2 years 11 months): Senior R&D Engineer, Samsung Electronics (Suwon, Korea).

## Awards & scholarships

- "Excellent Young Researchers" grant recipient from Korean government, 2019-2021.
- "Excellent Graduate Student Award" of the year 2016, Seoul National University.
- "Journal of Materials Chemistry C Poster Prize" at Metamaterials Congress 2015, Univ. of Oxford, UK.
- Samsung Global Scholarship (GSP-SNU) recipient: full tuition and living expenses for 2007-2009 M.Sc. course at Seoul National University.

## Additional skills & experience

Languages: **English** (fluent), **Korean** (advanced), **Russian** (native).

Professional software: MatLab, COMSOL, Lumerical FDTD, Code V, etc.

**Publications list** appended below.

**References** available upon request.

## - List of Publications -

<sup>†</sup>equal contribution; <sup>‡</sup>corresponding author

### Academic Papers

1. **Sergey G. Menabde** and Min Seok Jang<sup>‡</sup>, “Graphene unlocks dispersion of topological polaritons” *Nature Nanotechnology* **XX**, XXXX (2022).
2. Junhyung Kim, Geonwoo Lee, **Sergey G. Menabde**, Yong Jai Cho, Carsten Rockstuhl, and Min Seok Jang<sup>‡</sup>, “Temperature-Dependent Plasmonic Response of Graphene nanoribbons”, *ACS Photonics* **XX**, XXXX DOI: 10.1021/acsp Photonics.1c01966 (2022).
3. **Sergey G. Menabde**, Sergejs Boroviks, Jongtae Ahn, Jacob T. Heiden, Kenji Watanabe, Takashi Taniguchi, Tony Low, Do Kyung Hwang, N. Asger Mortensen<sup>‡</sup>, and Min Seok Jang<sup>‡</sup>, “Near-field probing of image phonon-polaritons in hexagonal boron nitride on gold crystals,” *Science Advances* **8**, eabn0627 (2022).
4. Hongyu Tang, **Sergey G. Menabde**, Tarique Anwar, Junhyung Kim, Min Seok Jang<sup>‡</sup>, and Giulia Tagliabue<sup>‡</sup>, “Photo-modulated optical and electrical properties of graphene,” *Nanophotonics* **11**, 917–940 (2022).
5. **Sergey G. Menabde**, Jacob T. Heiden, Joel D. Cox, N. Asger Mortensen<sup>‡</sup>, and Min Seok Jang<sup>‡</sup>, “Image polaritons in van der Waals crystals,” *Nanophotonics* **11**, 2433–2452 (2022).
6. Shinho Kim, **Sergey G. Menabde**, Joel D. Cox, Tony Low, and Min Seok Jang<sup>‡</sup>, “Ultracompact electro-optic waveguide modulator based on a graphene-covered  $\lambda/1000$  plasmonic nanogap,” *Optics Express* **29**, 13852-13863 (2021).
7. **Sergey G. Menabde**, In-Ho Lee, Sanghyub Lee, Heonhak Ha, Jacob T. Heiden, Daehan Yoo, Teun-Teun Kim, Tony Low, Young Hee Lee,<sup>‡</sup> Sang-Hyun Oh,<sup>‡</sup> and Min Seok Jang,<sup>‡</sup> “Real-space imaging of acoustic plasmons in large-area CVD graphene,” *Nature Communications* **12**, 938 (2021).
8. Sung Yoon Min, Ju Young Kim, Sunkyu Yu, **Sergey G. Menabde**,<sup>‡</sup> and Min Seok Jang,<sup>‡</sup> “Exceptional points in plasmonic waveguides do not require gain or loss,” *Physical Review Applied* **14**, 054041 (2020)
9. Seyoon Kim,<sup>†</sup> **Sergey Menabde**,<sup>†</sup> Victor W. Brar,<sup>‡</sup> and Min Seok Jang,<sup>‡</sup> “Functional Mid-Infrared Polaritonics in van der Waals Crystals,” *Advanced Optical Materials* **8**, 1901194 (2020).
10. Juho Park, Sanmun Kim, Joongwon Lee, **Sergey Menabde**,<sup>‡</sup> Min Seok Jang,<sup>‡</sup> “Ultimate light trapping in free-form plasmonic waveguide,” *Physical Review Applied* **12**, 024030 (2019).
11. Joel Siegel, Anthony Wang, **Sergey Menabde**, Mikhail A. Kats, Min Seok Jang, Victor W. Brar,<sup>‡</sup> “Self-Stabilizing Laser Sails Based on Optical Metasurfaces,” *ACS Photonics* **6**, 2032-2040 (2019).
12. Sanghoon Kim,<sup>†</sup> **Sergey Menabde**,<sup>†</sup> and Min Seok Jang,<sup>‡</sup> “Efficient Photodoping of Graphene in Perovskite–Graphene Heterostructure,” *Advanced Electronic Materials* **5**, 1800940 (2019).
13. Min Seok Jang,<sup>‡</sup> Seyoon Kim, Victor W. Brar, **Sergey Menabde**, and Harry A. Atwater, “Modulated Resonant Transmission of Graphene Plasmons Across a  $\lambda/50$  Plasmonic Waveguide Gap,” *Physical Review Applied* **10**, 054053 (2018).
14. **Sergey Menabde**, Hyunwoo Cho, and Namkyoo Park,<sup>‡</sup> “Interface defect-assisted phonon scattering of hot carriers in graphene,” *Physical Review B* **96**, 075426 (2017).
15. Viacheslav Shaidiuk, and **Sergey Menabde**,<sup>‡</sup> “Modal evolution in asymmetric three- and four-layer plasmonic waveguides,” *Optics Express* **24**, 16595-16608 (2016).
16. Viacheslav Shaidiuk,<sup>†</sup> **Sergey Menabde**,<sup>†</sup> and Namkyoo Park,<sup>‡</sup> “Effect of structural asymmetry on three layer plasmonic waveguide properties,” *JOSA B* **33**, pp. 963-970 (2016).

17. **Sergey Menabde**, Daniel R. Mason, Evgeny Kornev, Changhee Lee, and Namkyoo Park,<sup>‡</sup> “Direct Optical Probing of Transverse Electric Mode in Graphene,” *Scientific Reports* **6**, 21523 (2016).
18. Daniel R. Mason,<sup>†</sup> **Sergey Menabde**,<sup>†</sup> Sunkyu Yu, and Namkyoo Park,<sup>‡</sup> “Plasmonic Excitations of 1D Metal-Dielectric Interfaces in 2D Systems: 1D Surface Plasmon Polaritons,” *Scientific Reports* **4**, 4536 (2014).
19. Daniel R. Mason,<sup>†</sup> **Sergey Menabde**,<sup>†</sup> and Namkyoo Park,<sup>‡</sup> “Unusual Otto excitation dynamics and enhanced coupling of light to TE plasmons in graphene,” *Optics Express* **22**, pp. 847-858 (2014).
20. M. Sathish Kumar, **Sergey Menabde**, Sunkyu Yu, and Namkyoo Park,<sup>‡</sup> “Directional emission from photonic crystal waveguide terminations using particle swarm optimization,” *JOSA B* **27**, pp. 343-349 (2010).

### Patents

1. KR102203338 / Date: 2021.01.11 / Title: “GRAPHITE-BASED PHOTODETECTOR AND MANUFACTURING METHOD THEREOF” / Inventors: **Menabde, Sergey**; Jang, Min Seok / Assignee: KAIST.
2. KR102162023 / Date: 2020.09.25 / Title: “NANO-FILTER FOR TUNABLE TRANSMISSION OF INFRARED RADIATION AND MANUFACTURING METHOD THEREOF” / Inventors: **Menabde, Sergey**; Jang, Min Seok / Assignee: KAIST.
3. US9706902B2 / EP2596740B1/JP6126812B2 / CN103135211B / KR20130059150A / RU2621492C2 / Title: “Objective lens for endoscopic device, actuator for focusing, and endoscopic system” / US Patent date: Jul. 18, 2017 / Inventors: **Sergey Menabde** [primary], Jongchul Choi, Haein Chung / Assignee: Samsung Electronics.

### International Conferences (as first author and presenter only)

1. “Near-field Probing of Image Polaritons in van der Waals Crystals”, 2021 MRS Fall Meeting, Boston, USA, December 2021.
2. “Near-Field Probing of Image Phonon-Polaritons in van der Waals Crystal on crystalline gold”, Nanophotonics of 2D materials (N2D 2021), Spain, November 2021.
3. “Near-field probing of image polaritons in van der Waals crystals”, Recent Progress in Graphene and 2D Materials Research (RPGR 2021), Seoul, Korea, October 2021.
4. “Near-field study of infrared acoustic plasmon-polaritons in heterostructure with CVD graphene,” METANANO 2020, Tbilisi, Georgia, September 2020.
5. “Near-field study of infrared acoustic plasmon-polaritons in heterostructure with CVD graphene at room temperature,” Nanophotonics of 2D Materials (N2D) 2020, San Sebastian, Spain, July 2020.
6. “Ultimate light trapping in free-form plasmonic waveguide,” The 9<sup>th</sup> International Conference on Surface Polariton Photonics (SPP9), Copenhagen, Denmark, May 2019.
7. “Ultra-compact optical switch based on Fano resonance in graphene-functionalized plasmonic nano-cavity,” SPIE Nanoscience + Engineering 2018, San Diego, California, United States, August 2018.
8. “Role of interface defect in hot carriers extraction at graphene-metal contact,” SPIE Nanoscience + Engineering 2018, San Diego, California, United States, August 2018.
9. “Detection of exotic transverse electric mode in graphene,” Near Field Optics 14 (NFO’14), Hamamatsu, Japan, September 2016.
10. “Asymmetric plasmonic waveguides as platform for coupling between surface plasmons and propagating waves,” Near Field Optics 14 (NFO’14), Hamamatsu, Japan, September 2016.

11. "Detection of Transverse Plasmons in Multilayer Graphene," Metamaterial'2015 Congress, University of Oxford, UK, September 2015 (**award winner**: Journal of Materials Chemistry C Poster Prize).
12. "Enhanced coupling of light to TE plasmons in multilayer graphene," Near Field Optics 13 (NFO'13), Salt Lake City, USA, September 2014.
13. [Invited talk] "1-Dimensional Surface Plasmon Polaritons in 2-Dimensional Systems," 3rd Korea-Japan Metamaterials Forum 2013, K1, Seoul, June 2013.
14. "Non-Abrupt-Edge Effects on Graphene Edge Plasmon Dispersion," Conference on Surface Plasmon-Polaritons (SPP6), Ottawa, Canada, 25-31 May 2013.
15. "Small-size Zoom Lens Design," Optics-Photonics Design & Fabrication ODF'06, Nara, Japan, December 2006.
16. "Automated zoom lens design," Frontiers in Optics 2006, Rochester, USA, October 2006.
17. "Automated zoom lens design and second-order derivative optimization methods," Optics & Photonics 2006, San-Diego, USA, August 2006.

### **Domestic (Korean) Conferences**

1. [Invited talk] "Real-space mapping of infrared acoustic plasmons in CVD graphene," 제 19 회 첨단레이저 및 레이저 응용 워크샵 ALTA-2020, Jeju, Korea, August 2020.
2. [Invited talk] "Graphene photodoping platform for active and gate-less photonic devices," The 26<sup>th</sup> Conference on Optoelectronics and Optical Communications (COOC 2019), Busan, Korea, June 2019.
3. [Plenary talk] "Low Dimensional Nano-Photonic Systems," OSK Annual Summer Meeting 2014, Cheju, Korea, August 2014.