

Hyukmo Kang

hkang.april@gmail.com | +82-10-2773-4941

ORCID: 0000-0002-2224-1353 | Google Scholar

Space Metrology Group, Korea Research Institute of Standards and Science, Daejeon, Republic of Korea

Research Interests

- Ultra-precision manufacturing processes for large-aperture and freeform optical components in space and other strategic technology applications
- Physics-based and data-driven modeling and optimization of fabrication processes, including dwell-time and tool-path optimization for deterministic surfacing
- In-process and on-machine metrology for closed-loop manufacturing: deflectometry, interferometry, and coordinate measuring machine
- Digital-twin simulation of metrology and optical systems for design, alignment, and performance verification

Education

Ph.D., Optical Sciences, University of Arizona, Tucson, AZ 2022

Dissertation: *Design, Fabrication, and Alignment in Modern Optics* (Advisor: Daewook Kim)

M.S., Optical Sciences, University of Arizona, Tucson, AZ 2021

M.S., Astronomy, Yonsei University, Seoul, Republic of Korea 2016

B.S., Astronomy, Yonsei University, Seoul, Republic of Korea 2014

Research Experience

Korea Research Institute of Standards and Science (KRISS) Mar 2026 – Present

Postdoctoral Researcher, Space Metrology Group Daejeon, Republic of Korea

- Designing and building a deflectometry system for large SiC space-telescope mirrors.
- Co-developed complex-phaser principal component analysis (Phasor-PCA) for turbulence-robust interferometric testing of large-aperture mirrors.
- Co-developed an optimization-based cosine-error compensation method for touch-probe CMM metrology of off-axis aspheric mirrors.
- Co-developed an interferometric qualification method for meniscus null lenses using complementary reflected and transmitted wavefront tests.
- Supervised graduate student research and publications as corresponding author, a role delegated by the principal investigator.
- Implementing an edge reconstruction algorithm for the infrared quadri-wave lateral shearing interferometer.

University of Arizona — LOFT Group, UASAL

May 2022 – Oct 2025

Postdoctoral Researcher

Tucson, AZ

- Led the optical design and assembly/alignment planning for PUFFINS, a SmallSat UV spectro-polarimeter selected under the NASA Astrophysics Pioneers Program.
- Developed a tool-path planning algorithm for robotic polishing of large mirrors.
- Developed an inline scanning metrology system using part motion for large-aperture mirror characterization.
- Conceived and mentored research on computational alignment of multi-mirror telescopes, toward automated alignment for mass production of compact systems such as CubeSat optics.
- Contributed to dwell-time optimization and machine scheduling algorithms for computer-controlled optical surfacing (CCOS) (E-PVT, CUDO).
- Developed an image-based wavefront feedback control testbed with a piezo/motor-actuated telescope simulator for the 3-m Lazuli space telescope.

- Developed a non-sequential dwell-time optimization algorithm for CCOS of large optics using a genetic algorithm.
- Developed an automated alignment and calibration algorithm for on-machine deflectometry of freeform automotive head-up display (HUD) optics in collaboration with an industry partner.
- Developed a ray-tracing simulator of the deflectometry system to improve measurement precision and efficiency, toward a digital twin of the measurement process.
- Characterized surface deformation of a 1-m inflatable space reflector under thermal-vacuum (TVAC) conditions using deflectometry.
- Led end-to-end development of MOBIUS, a cryogenic plug-in cross-dispersion module for the Large Binocular Telescope (LBT), from opto-mechanical design and tolerance analysis through fabrication, assembly, alignment, and testing.
- Designed a freeform lens prototype for an augmented reality (AR) wearable device.

Korea Research Institute of Standards and Science (KRISS)
Graduate Research Assistant, Center for Space Optics

Jul 2015 – Jul 2016
Republic of Korea

- Developed a probe radius correction algorithm for contact CMM; measured surface error of an off-axis parabolic mirror at the grinding stage.
- Assembled, aligned, and characterized a mid-altitude UAV electro-optical camera system using interferometry and CMM.

Korea Institute of Ocean Science & Technology (KIOST)
Graduate Research Assistant, Korea Ocean Satellite Center

Dec 2013 – Jun 2015
Republic of Korea

- Performed tolerance analysis and led precision assembly and alignment of a three-mirror anastigmat (TMA) system for coastal water remote sensing.

Grants & Funding

PUFFINS SmallSat UV Spectro-polarimeter Mission (\$20M) *2026 – 2031 (awarded)*
NASA Astrophysics Pioneers Program Co-Investigator / Optical Lead

Teaching Experience

Tutor, Practical Optics Workshop (POW), University of Arizona	<i>2018 – 2025</i>
Teaching Assistant, OPTI 513R: Optical Testing, University of Arizona	<i>2017, 2018</i>
Teaching Assistant, Understanding of Space, Yonsei University	<i>2015</i>

Honors & Awards

Robert R. Shannon Graduate Student Endowed Scholarship *2018*
Friends of Tucson Optics (FoTO), Wyant College of Optical Sciences, University of Arizona
Competitive scholarship awarded to the top 30 incoming Ph.D. students annually; full tuition and stipend support.

Publications

H. Kang = self; * = corresponding author; † = equal contribution.

Summary: 28 peer-reviewed journal articles (6 as first or corresponding author), 1 manuscript under review, 40+ conference papers.

Journal Articles — First or Corresponding Author

1. **H. Kang**^{†*}, I.-U. Song[†], J.-H. Choi[†], and H.-S. Yang, “Interferometric qualification of a meniscus lens using complementary reflected and transmitted wavefront testing,” *Applied Optics* **65**(30) (2026), doi:10.1364/AO.608306.
2. **H. Kang**, H. Kihm, and H.-S. Yang, “Metrology chain for space optics,” *Current Optics and Photonics*, invited review, accepted (2026).
3. C. Kim, **H. Kang**^{*}, H. Choi, B. Jeong, Y. Huang, S. Pak, and D. Kim, “Alignment of multi-mirror telescopes with computational vector fiducials and reverse optimization,” *Applied Optics* **65**(13), 4240–4251 (2026).
4. **H. Kang**, D. Thompson, A. Conrad, J. Wiese, H. Choi, V. Reddy, and D. Kim, “Plug-in cross-dispersing module for the Large Binocular Telescope’s infrared spectrograph LUCI,” *Journal of Astronomical Telescopes, Instruments, and Systems* **8**(4), 045003 (2022).
5. **H. Kang**, T. Wang, H. Choi, and D. Kim, “Genetic algorithm-powered non-sequential dwell time optimization for large optics fabrication,” *Optics Express* **30**(10), 16442–16458 (2022).
6. **H. Kang**, H. Quach, J. Berkson, M. Aftab, G. Smith, H. Choi, and D. Kim, “Computational vector fiducial for deflectometry system alignment,” *Optics Letters* **46**(22), 5571–5574 (2021).

Manuscripts Under Review

1. C. Lee, H.-S. Yang, and **H. Kang**^{*}, “Cosine-error compensation for off-axis aspheric mirror metrology via touch-probe coordinate optimization,” *International Journal of Precision Engineering and Manufacturing*, under review (2026).

Journal Articles — Co-author

1. S. A. Blomquist, H. Kim, H. Choi, **H. Kang**, et al., “On-orbit coarse alignment of three mirror anastigmat telescopes utilizing blind scanning and stochastic processes,” *J. Astron. Telesc. Instrum. Syst.* **12**(3), 039003 (2026).
2. Y. Huang, R. Angel, **H. Kang**, H. Choi, et al., “Static screen deflectometry for heliostat metrology,” *Renewable Energy*, 125595 (2026).
3. T. Wang, L. Huang, X. Ke, et al., **H. Kang**, et al., “CUDO: closed-form universal dwell-time optimization for computer-controlled optical surfacing,” *Optics Express* **33**(24), 50201–50214 (2025).
4. S. Berwal, B. Singh, V. Negi, **H. Kang**, D. Kim, and N. Khatri, “Quasi-Cassegrain off-axis concentrator using a corrective hyperbolic-freeform secondary mirror for space solar-powered lasers,” *Journal of Optics* **27**(6), 065901 (2025).
5. T. Wang, X. Ke, L. Huang, et al., **H. Kang**, et al., “A comprehensive review of dwell time optimization methods in computer-controlled optical surfacing,” *Light: Advanced Manufacturing* **5**(3), 422–451 (2024).
6. X. Ke, J. Fan, T. Wang, et al., **H. Kang**, et al., “E-PVT: enhanced position-velocity-time scheduler for computer-controlled optical finishing with comprehensive considerations of dynamics constraints, continuity and efficiency,” *Optics Express* **32**(9), 15507–15526 (2024).
7. L. Huang, T. Wang, J. Yamada, et al., **H. Kang**, et al., “Manufacturability-based optical design optimization for advanced Kirkpatrick–Baez X-ray focusing mirrors,” *Optics Express* **32**(15), 25755–25771 (2024).
8. J.-S. Park, S. W. D. Lim, A. Amirzhan, **H. Kang**, et al., “All-glass 100 mm diameter visible metalens for imaging the cosmos,” *ACS Nano* **18**(4), 3187 (2024).

9. J. Berkson, J. Hyatt, **H. Kang**, S. Ordonez, H. Quach, and D. Kim, “Binocular fringe projection profilometry for the metrology of meter-scale optical surfaces,” *Optics Continuum* **2**(4), 697–711 (2023).
10. D. Kim, **H. Kang**, J. Wiese, H. Choi, A. Conrad, V. Reddy, and D. Thompson, “Deployable cryogenic cross-dispersing unit for simultaneous zJHK spectroscopy,” *Optical Review* **30**(2), 232–237 (2023).
11. H. Quach, **H. Kang**, B. Jeong, H. Choi, and D. Kim, “Non-planar illumination deflectometry for axicon metrology,” *Optics Letters* **47**(15), 3636–3639 (2022).
12. S. Sirsi, H. Quach, **H. Kang**, et al., “Modeling and characterization of OASIS inflatable primary antenna by dual modality metrology,” *Optics Express* **30**(19), 33479–33489 (2022).
13. H. Quach, **H. Kang**, S. Sirsi, A. Chandra, H. Choi, et al., “Surface measurement of a large inflatable reflector in cryogenic vacuum,” *Photonics* **9**(1), 1 (2022).
14. D. Kim, H. Choi, T. Brendel, H. Quach, M. Esparza, **H. Kang**, et al., “Advances in optical engineering for future telescopes,” *Opto-Electronic Advances* **4**(6), 210040 (2021).
15. D. W. Kim, G. A. Smith, M. Dubin, et al., **H. Kang**, et al., “Advances in reconfigurable optical design, metrology, characterization, and data analysis,” *Journal of Physics: Photonics* **3**(2), 022003 (2021).
16. H. Choi, I. Trumper, Y.-T. Feng, **H. Kang**, et al., “Long-slit cross-dispersion spectroscopy for Hyperion UV space telescope,” *J. Astron. Telesc. Instrum. Syst.* **7**(1), 014006 (2021).
17. T. Wang, L. Huang, Y. Zhu, et al., **H. Kang**, et al., “Development of a position–velocity–time–modulated two-dimensional ion beam figuring system for synchrotron x-ray mirror fabrication,” *Applied Optics* **59**(11), 3306–3314 (2020).
18. T. Wang, L. Huang, **H. Kang**, H. Choi, D. W. Kim, K. Tayabaly, and M. Idir, “RIFTA: A robust iterative Fourier transform-based dwell time algorithm for ultra-precision ion beam figuring of synchrotron mirrors,” *Scientific Reports* **10**, 8135 (2020).
19. M. Z. Dominguez, **H. Kang**, S. Kim, et al., “Multi-field merit-function-based regression method for Wide Field Infrared Survey Telescope grism system alignment,” *Applied Optics* **58**(25), 6802–6812 (2019).
20. H. K. Ahn, **H. Kang**, Y.-S. Ghim, and H.-S. Yang, “Touch probe tip compensation using a novel transformation algorithm for coordinate measurements of curved surfaces,” *International Journal of Precision Engineering and Manufacturing* **20**(2), 193–199 (2019).
21. M.-W. Jeon, S.-W. Hyun, J.-Y. Bae, B.-J. Jeong, E.-S. Oh, **H. Kang**, et al., “Development of an off-axis TMA telescope for coastal water remote sensing,” *International Journal of Precision Engineering and Manufacturing* **17**(5), 685–689 (2016).
22. E. Oh, **H. Kang**, S. Hyun, G.-H. Kim, Y. Park, J.-K. Choi, and S.-W. Kim, “Design and performance analysis of an off-axis three-mirror telescope for remote sensing of coastal water,” *Korean Journal of Optics and Photonics* **26**(3), 155 (2015) (in Korean).

Selected Conference Proceedings — First or Corresponding Author

1. M. Yoo, **H. Kang**^{*}, H. Choi, V. S. Negi, and D. Kim, “Scalable inline scanning deflectometry using unit-under-test motion,” *Proc. SPIE* **13603**, 59–65 (2025).
2. **H. Kang**, K. Van Gorkom, S. Blomquist, M. Y. Kautz, H. Choi, D. Kim, and E. S. Douglas, “Design and assembly of the telescope simulator for continuous wavefront sensing and control,” *Proc. SPIE* **13624**, 1362427 (2025).
3. **H. Kang**, K. Van Gorkom, M. Biswas, D. Kim, and E. S. Douglas, “Focus diverse phase retrieval test results on broadband continuous wavefront sensing in space telescope applications,” *Proc. SPIE* **13134**, 131340A (2024).
4. **H. Kang**, K. Van Gorkom, J. Johnson, O. Singelstad, A. Goldtooth, D. Kim, and E. S. Douglas, “Focus diverse phase retrieval testbed development of continuous wavefront sensing for space telescope applications,” *Proc. SPIE* **12677**, 126770G (2023).

5. **H. Kang**, H. Quach, H. Choi, G. A. Smith, and D. W. Kim, “Computational alignment of on-machine deflectometry,” *Proc. SPIE* **11487**, 114870O (2020).
6. **H. Kang**, D. Thompson, A. Conrad, C. Vogel, A. Lamdan, and D. Kim, “Modular plug-in extension enabling cross-dispersed spectroscopy for Large Binocular Telescope,” *Proc. SPIE* **11116**, 45–51 (2019).
7. **H. Kang**, E. Oh, and S.-W. Kim, “Alignment performance comparison between MFR and MDCO for a TMA optical system,” *Proc. SPIE* **9582** (2015).