



Sungwook E. HONG

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Astronomy & Space  
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# Sungwook E. HONG

## Research Interests

Large-scale Structure of the Universe; Cosmological Simulations; Deep Learning in Astronomy; Astrobiology; Cosmic Reionization; Astronomical Instrumentation

## Education

**2004 – 2011, Korea Advanced Institute of Science and Technology**

MS & PhD Integrated Degree in Physics

**2000 – 2004, Korea Advanced Institute of Science and Technology**

BS in Physics

## Experience

**Sep 2024 – , Astronomy Campus, University of Science and Technology**

Professor

**May 2024 – , Korea Astronomy and Space Science Institute**

Principal Researcher

**Sep 2021 – Aug 2024, Astronomy Campus, University of Science and Technology**

Associate Professor

**Oct 2020 – Apr 2024, Korea Astronomy and Space Science Institute**

Senior Researcher

**Sep 2018 – Sep 2020, University of Seoul**

Research Professor

**Dec 2016 – Aug 2018, Korea Astronomy and Space Science Institute**

Researcher

**Jan 2013 – Nov 2016, Korea Institute for Advanced Study**

KDES/QUC Research Fellow

**Oct 2011 – Jan 2013, Chungnam National University**

Postdoctoral Researcher

**Mar 2011 – Sep 2011, Korea Advanced Institute of Science and Technology**

Postdoctoral Researcher

## Awards

**2023, Oral Presentation Award, Korean Space Science Society**

**2020, Young Astronomer's Award, Korean Astronomical Society**

for contributing to Korean astronomy by participation in large-volume numerical simulations for understanding the large-scale structures of the Universe and by the development of data analysis and application methods for understanding the nature of dark energy.

**2015, Annual Best Science Paper Award, The Korea Federation of Science and Technology Societies**

Title: *2D genus topology of 21-cm differential brightness temperature during cosmic reionization*



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## Service

### Journal Reviewer

Monthly Notices of the Royal Astronomical Society; Journal of the Korean Astronomical Society; Publications of the Korean Astronomical Society; Journal of the Korean Physical Society; Journal of the Astronomical Instrumentation; New Physics; Nuclear Physics B

### Conference Organizer

- 2021 –, Korea Astronomy Machine Learning Workshop
- 2020 –, Workshop on Instrumentation for Astronomy and Space Science
- 2014, 2016 & 2020, KIAS Workshop on Cosmology and Structure Formation
- 2019, Workshop on ML in Astronomy and Astrophysics
- 2017 – 2018, K-GMT Science Program Users Meeting

### Committee

- 2023 –, Academic Committee, Korean Astronomical Society
- 2019 –, Instrumentation Division, Korean Astronomical Society
- 2019 –, Korea Astronomy Machine Learning (KAML)
- 2022 – 2023, Astrophysics Division, Korean Physics Society
- 2020 – 2021, Korean Astronomy Encyclopedia, Korean Astronomical Society
- 2017 – 2018, K-GMT Science & Instrumentation Working Group
- 2017 – 2018, The 2nd K-GMT Science White Paper Committee

## Media Coverage

### The Junior Science Donga Magazine

“Welcome to the Universe!” (Jan 2024 – ; *author*)

### YTN Science: Docu S Prime (*interviewee*)

- “Dark matter: The unknown in our world” (Mar 2024)
- “Scientific approach to exploring beyond the Earth” (Feb 2023)
- “Truth about UFO and extraterrestrial life” (Oct 2021)

### 90 Nights of Universe (May 2023; *co-author*)

- *Excellent General-reading Book for Youth*, Korean Publishing Foundation (2023)
- *Sejong Recommended Book*, Publication Industry Promotion Agency of Korea (2023)

### YTN Science: I'll Here the Stars (*interviewee*)

- “Unseen, but ever there — About dark matter & dark energy” (Feb 2023)
- “Is our world everything? — About multiverse & parallel universes” (Dec 2022)

### Physics & High Technology

“A conversation among young astrophysicists” (Jul 2021; *co-author*)

### The Math Donga Magazine (*consultant*)

- “Imagination with mathematics: How does the Universe look like?” (Sep 2017)
- “Mathematics is the alien language!” (Apr 2017)

### Horizon (*author*)

- “Analysis of 21cm radio signal from the epoch of cosmic reionization” (Mar 2017)
- “Spatial and velocity distribution of galaxies in cluster from cosmological simulations” (Mar 2015)

### The Science Donga Magazine

“To the universe: Answer me, alien civilizations!” (Oct 2016; *author*)



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## Publications

65. [Emergence of the galaxy morphology-star formation activity-clustercentric radius relations in galaxy clusters](#)  
Hong, S.E., Park, C., Mishra, P.K., Kim, J., Gibson, B.K. *et al.*, ApJ submitted
64. [MulGuisin, a topological clustering algorithm, and its performance as a cosmic structure finder](#)  
Ju, Y., Park, I., Sabiu, C.G. & Hong, S.E., JKAS submitted, arXiv:2301.03278
63. [Panel discussion: Practical problem solving for machine learning](#)  
Cabrera, G., Hong, S.E., Nakazono, L., Parkinson, D. & Ting, Y.-S., Proc. IAU accepted, arXiv:2211.16782
62. [Final parsec problem of black hole mergers and ultralight dark matter](#)  
Koo, H., Bak, D., Park, I., Hong, S.E. & Lee, J.-W., PLB 856, 138908 (Sep 2024)
61. [The environmental dependence of the stellar mass-gas metallicity relation in Horizon Run 5](#)  
Rowntree, A.R., Singh, A., Vincenzo, F. *et al.*, MNRAS 531, 3858 (Jun 2024); MNRAS 532, 3567 (Aug 2024)
60. [Merger-tree-based galaxy matching: A comparative study across different resolutions](#)  
Jung, M., Kim, J.-h., Oh, B.K. *et al.*, ApJ 965, 156 (Apr 2024)
59. [The effects of non-linearity on the growth rate constraint from velocity correlation functions](#)  
Tonegawa, M., Appleby, S., Park, C., Hong, S.E. & Kim, J., MNRAS 529, 4787 (Apr 2024)
58. [Maunakea Spectroscopic Explorer exposure time calculator for end-to-end simulator: to optimizing spectrograph design and observing simulation](#)  
Ji, T.-G., Sobeck, J., Kim, C. *et al.*, JATIS 10, 018001 (Jan 2024)
57. [Modeling cosmological perturbations of thermal inflation](#)  
Bae, J.-M., Hong, S.E. & Zoe, H., CQG 41, 015024 (Dec 2023)
56. [Cosmological parameter constraints from the SDSS density and momentum power spectra](#)  
Appleby, S., Tonegawa, M., Park, C. *et al.*, ApJ 958, 180 (Nov 2023)
55. [The universe is worth  \$64^3\$  pixels: Convolution neural network and vision transformers for cosmology](#)  
Hwang, S.Y., Sabiu, C.G., Park, I. & Hong, S.E., JCAP 11(2023), 075 (Nov 2023)
54. [Detecting interstellar objects by using space weather data](#)  
Kwon, R.-Y., Kim, M., Hong, S.E. & Hoang, T., PKAS 38, 91 (Aug 2023)
53. [Search for technosignature](#)  
Hong, S.E., Sohn, B.W., Jung, T. *et al.*, PKAS 38, 75 (Aug 2023)
52. [Search for radio technosignature from the farside of the Moon](#)  
Kim, M., Hong, S.E., Jung, T. *et al.*, PKAS 38, 59 (Aug 2023)
51. [Search for biosignature in the solar system](#)  
Kim, M., Chung, S.-J., Shin, M.-S. & Hong, S.E., PKAS 38, 37 (Aug 2023)
50. [The prospect of interstellar object explorations for searching life in cosmos](#)  
Kim, M., Kwon, R.-Y., Hoang, T. & Hong, S.E., PKAS 38, 25 (Aug 2023)
49. [Exoplanets and habitability](#)  
Hong, S.E., Kwon, R.-Y., Kim, Y., Kang, H. & Kim, M., PKAS 38, 13 (Aug 2023)
48. [Tomographic Alcock-Paczynski test with redshift-space correlation function: Evidence for the dark energy equation of state parameter  \$w > -1\$](#)   
Dong, F., Park, C., Hong, S.E. *et al.*, ApJ 953, 98 (Aug 2023)



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47. [Cluster-counterpart voids: Void identification from galaxy density field](#)  
Shim, J., Park, C., Kim, J. & Hong, S.E., *ApJ* 952, 59 (Jul 2023)
46. [Reconstructing the cosmological density and velocity fields from redshifted galaxy distributions using V-net](#)  
Qin, F., Parkinson, D., Hong, S.E. & Sabiu, C.G., *JCAP* 06(2023), 062 (Jun 2023)
45. [Cosmic gas highways in C-EAGLE simulations](#)  
Vurm, I., Nevelainen, J., Hong, S.E. *et al.*, *A&A* 673, A62 (May 2023)
44. [Machine-guided exploration and calibration of astrophysical simulations](#)  
Oh, B.K., An, H., Shin, E.-j., Kim, J.-h. & Hong, S.E., *MNRAS* 515, 693 (Sep 2022); *MNRAS* 521, 5760 (Apr 2023)
43. [An exposure time calculator for the Maunakea Spectroscopic Explorer](#)  
Ji, T.-G., Kim, T., Kim, C., *et al.* *Proc. SPIE* 12189, 121892N (Aug 2022)
42. [Minkowski functionals of SDSS-III BOSS: Hints of possible anisotropy in the density field?](#)  
Appleby, S., Park, C., Pranav, P. *et al.*, *ApJ* 928, 108 (Apr 2022)
41. [Weak-lensing mass reconstruction of galaxy clusters with convolutional neural network](#)  
Hong, S.E., Park, S., Jee, M.J., Bak, D., & Cha, S., *ApJ* 923, 266 (Dec 2021)
40. [Proposal of joint planning working group for development of Korean Space Telescopes](#)  
Han, J.-Y., Park, W., Jun, Y. *et al.*, *JSTA* 1, 283 (Nov 2021)
39. [Panspermia in a Milky Way-like galaxy](#)  
Gobat, R., Hong, S.E., Snaith, O., & Hong, S., *ApJ* 921, 157 (Nov 2021)
38. [Revealing the local cosmic web from galaxies by deep learning](#)  
Hong, S.E., Jeong, D., Hwang, H.S., & Kim, J., *ApJ* 913, 76 (May 2021)
37. [The Horizon Run 5 cosmological hydrodynamic simulation: Probing galaxy formation from kilo- to giga-parsec scales](#)  
Lee, J., Shin, J., Snaith, O.N., *et al.*, *ApJ* 908, 11 (Feb 2021)
36. [Cosmological parameter estimation from the two-dimensional genus topology — Measuring the expansion history using the genus amplitude as a standard ruler](#)  
Appleby, S., Park, C., Hong, S.E., *et al.*, *ApJ* 907, 75 (Feb 2021)
35. [Deep-learning study of the 21-cm differential brightness temperature during the epoch of reionization](#)  
Kwon, Y., Hong, S.E., & Park, I., *JKPS* 77, 49 (Jul 2020)
34. [Cosmological information from the small-scale redshift space distortions](#)  
Tonegawa, M., Park, C., Zheng, Y., *et al.*, *ApJ* 897, 17 (Jun 2020)
33. [Cosmological parameter estimation from the two-dimensional genus topology — Measuring the shape of the matter power spectrum](#)  
Appleby, S., Park, C., Hong, S.E., Hwang, H.S., & Kim, J., *ApJ* 896, 145 (Jun 2020)
32. [SCUBA-2 Ultra Deep Imaging EAO Survey \(STUDIES\) IV. Spatial clustering and halo masses of submillimeter galaxies](#)  
Lim, C.-F., Chen, C.-C., Wang, W.-H., *et al.*, *ApJ* 895, 104 (Jun 2020)
31. [Constraining cosmology with big data statistics of cosmological graphs](#)  
Hong, S., Jeong, D., Hwang, H.S., *et al.*, *MNRAS* 493, 5972 (Feb 2020)
30. [MANIFEST metrology toolkit](#)  
Goodwin, M. & Hong, S.E., *Proc. SPIE* 11203, 112031C (Jan 2020)





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**29. Alcock-Paczynski test with the evolution of redshift-space galaxy clustering anisotropy**

Park, H., Park, C., Sabiu, C.G., *et al.* ApJ 881, 146 (Aug 2019)

**28. Multiple rooks of chess: A generic integral field unit deployment technique**

Chattopadhyay, S., Ramaprakash, A.N., Khodade, P., *et al.* Proc. SPIE 10706, 107065S (Jul 2018)

**27. Noise characterization of IUCAA digital sampling array controller**

Chattopadhyay, S., Ramaprakash, A.N., Joshi, B., *et al.* JATIS 4, 036002 (Jul 2018)

**26. Wide-field multi-object spectroscopy with MANIFEST**

Lawrence, J., Ben-Ami, S., Brown, D.M., *et al.* Proc. SPIE 10702, 10702A6 (Jul 2018)

**25. DOTIFS: Spectrograph optical and opto-mechanical design**

Chung, H., Ramaprakash, A.N., Khodade, P., *et al.* Proc. SPIE 10702, 107027A (Jul 2018)

**24. Minkowski tensors in two dimensions: Probing the morphology and isotropy of the matter and galaxy density fields**

Appleby, S., Chingangbam, P., Park, C., *et al.* ApJ 858, 87 (May 2018)

**23. Cosmological constraints from the redshift dependence of the Alcock-Paczynski effect: Dynamical dark energy**

Li, X.-D., Sabiu, C.G., Park, C., *et al.* ApJ 856, 88 (Apr 2018)

**22. A question of separation: Disentangling tracer bias and gravitational non-linearity with counts-in-cells statistics**

Uhlemann, C., Feix, M., Codis, S., *et al.* MNRAS 473, 5098 (Feb 2018)

**21. Cosmological parameter estimation using the genus amplitude — Application to mock galaxy catalogs**

Appleby, S., Park, C., **Hong, S.E.**, & Kim, J., ApJ 853, 17 (Jan 2018)

**20. Small-scale effects of thermal inflation on halo abundance at high- $z$ , galaxy substructure abundance, and 21-cm power spectrum**

**Hong, S.E.**, Zoe, H., & Ahn, K., PRD 96, 103515 (Nov 2017)

**19. CMB spectral distortion constraints on thermal inflation**

Cho, K., **Hong, S.E.**, Stewart, E.D., & Zoe, H., JCAP 08(2017), 002 (Aug 2017)

**18. Cosmological constraints from the redshift dependence of the volume effect using the galaxy 2-point correlation function across the line of sight**

Li, X.-D., Park, C., Sabiu, C.G., *et al.* ApJ 844, 91 (Aug 2017)

**17. Topology of large-scale structure of galaxies in two dimensions — Systematic effects**

Appleby, S., Park, C., **Hong, S.E.**, & Kim, J., ApJ 836, 45 (Feb 2017)

**16. Cosmological constraints from the redshift dependence of the Alcock-Paczynski effect: Application to the SDSS-III BOSS DR12 galaxies**

Li, X.-D., Park, C., Sabiu, C.G., *et al.* ApJ 832, 103 (Dec 2016)

**15. AAO Starbugs: Software control and associated algorithms**

Lorente, N.P.F., Vuong, M.V., Shortridge, K., *et al.* Proc. SPIE 9913, 99130U (Aug 2016)

**14. Evolution of galaxy habitability**

Gobat, R. & **Hong, S.E.**, A&A 592, 96 (Aug 2016)

**13. The most bound halo particle-galaxy correspondence model: Comparison between models with different merger timescales**

**Hong, S.E.**, Park, C., & Kim, J., ApJ 823, 103 (May 2016)



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**12. Radio and X-ray shocks in clusters of galaxies**

**Hong, S.E.**, Kang, H., & Ryu, D., ApJ 812, 49 (Oct 2015)

**11. Horizon Run 4 simulation: Coupled evolution of galaxies and large-scale structures of the universe**

Kim, J., Park, C., L'Huillier, B., & **Hong, S.E.**, JKAS 48, 213 (Aug 2015)

**10. Effects of thermal inflation on small scale density perturbations**

**Hong, S.E.**, Lee, H.-J., Lee, Y.J., Stewart, E.D., & Zoe, H., JCAP 06(2015), 002 (Jun 2015)

**9. March of the Starbugs: Configuring fibre-bearing robots on the UK-Schmidt optical plane**

Lorente, N., Vuong, M., Satorre, C., *et al.* Proc. ADASS XXIV, 265 (Mar 2015)

**8. Field target allocation and routing algorithms for Starbugs**

Goodwin, M., Lorente, N., Satorre, C., *et al.* Proc. SPIE 9152, 91520S (Jul 2014)

**7. 2D genus topology of 21-cm differential brightness temperature during cosmic reionization**

**Hong, S.E.**, Ahn, K., Park, C., *et al.* JKAS 47, 49 (Apr 2014)

**6. Shock waves and cosmic ray acceleration in the outskirts of galaxy clusters**

**Hong, S.E.**, Ryu, D., Kang, H., & Cen, R., ApJ 785, 133 (Mar 2014)

**5. The possibility of inflation in asymptotically safe gravity**

**Hong, S.E.**, Lee, Y.J., & Zoe, H., IJMPD 21, 1250062 (Jul 2012)

**4. Anthropic likelihood for the cosmological constant and the primordial density perturbation amplitude**

**Hong, S.E.**, Stewart, E.D., & Zoe, H., PRD 85, 083510 (Apr 2012)

**3. The causal structure of dynamical charged black holes**

**Hong, S.E.**, Hwang, D.-i., Stewart, E.D., & Yeom, D.-h., CQG 27, 045014 (Feb 2010)

**2. Critical review on holographic measure over the multiverse**

**Hong, S.E.**, Yeom, D.-h., & Zoe, H., Int. J. Conf. Ser. 1, 377 (Dec 2009)

**1. Black hole complementarity with local horizons and Horowitz-Maldacena's proposal**

**Hong, S.E.**, Hwang, D.-i., Yeom, D.-h., & Zoe, H., JHEP 12(2008), 080 (Dec 2008)



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## Scientific Talks

### Recent development status of A-SPEC: All-sky Spectroscopic Survey

- Jul 2024, *2024 Workshop on Instrumentation for Astronomy and Space Science*, Gyeongju, Korea
- Feb 2022, *The 10th Survey Science Workshop*, Jeongseon, Korea (invited)

### Panspermia in a Milky Way-like galaxy

- Apr 2024, *Korean Astronomical Society Spring Meeting 2024*, Yeosu, Korea
- Oct 2022, *The 10th KIAS Workshop on Cosmology and Structure Formation*, Seoul, Korea (invited)
- Oct 2021, *Korean Astronomical Society Fall Meeting 2021*, Jeju, Korea

### Feasibility study for the next-generation spectroscopic survey with dedicated large telescopes

- Jan 2024, *Survey Science Group Workshop 2024*, Jeongseon, Korea (invited)
- Aug 2023, *The 4th Korea Geoscience Union Annual Meeting*, Busan, Korea
- Jan 2023, *Survey Science Group Workshop 2023*, Jeongseon, Korea (invited)

### Review on the recent studies about the habitability ( $+α$ )

- Oct 2023, *Korean Space Science Society Fall Meeting 2023*, Yeosu, Korea
- Jun 2023, *KSAS Space Workshop 2023*, Yeosu, Korea
- Oct 2021, *Korean Astronomical Society Fall Meeting 2021*, Jeju, Korea

### Emergence of galaxy morphology-star formation rate-clustercentric radius relation in galaxy clusters

- Oct 2023, *Korean Astronomical Society Fall Meeting 2023*, Jeju, Korea
- Aug 2023, *2023 Asia-Pacific Regional IAU Meeting*, Koriyama, Japan

### Dark matter and the large-scale structure of the universe

- Apr 2023, *Korean Physical Society Spring Meeting 2023*, Daejeon, Korea (invited)

### Weak-lensing mass reconstruction of galaxy clusters with convolutional neural network

- Aug 2022, *IAU General Assembly 2022 Focus Meeting 3: Consensus Cosmic Shear in the 2020s*, Busan, Korea
- Sep 2021, *ESA/ESAC Galaxy Cluster Mass Meeting 2021*, Online
- Oct 2020, *Korean Astronomical Society Meeting 2020*, Daejeon, Korea
- Jul 2020, *Korean Physical Society Spring Meeting 2020*, Online
- Feb 2020, *The 9th Survey Science Group Workshop*, Jeongseon, Korea

### Revealing the local cosmic web from galaxies by deep learning

- Aug 2022, *IAU General Assembly 2022 Symposium 368: Machine Learning in Astrophysics: Possibilities and Pitfalls*, Online
- Apr 2022, *TRP: The Origin and Evolution of the Universe*, Gwangju, Korea (invited)
- Apr 2022, *GW Universe Focus Workshop: Machine Learning & Artificial Intelligence in GW Universe Research*, Online (invited)
- Jul 2021, *CLUES Collaborational Meeting*, Online (invited)
- Dec 2020, *7th Korea-Japan Workshop on Dark Energy*, Online (invited)
- Nov 2020, *Astroparticle: The Next Frontier of Fundamental Physics*, Pohang, Korea (invited)
- Nov 2020, *AAPPS-DACG Workshop on Astrophysics, Cosmology and Gravitation*, Online
- Nov 2020, *The 9th KIAS Workshop on Cosmology and Structure Formation*, Seoul, Korea
- Aug 2020, *14th International Conference on Gravitation, Astrophysics, and Cosmology*, Online
- Oct 2019, *Korean Physical Society Fall Meeting 2019*, Gwangju, Korea
- Oct 2019, *Korean Astronomical Society Fall Meeting 2019*, Seoul, Korea



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### Machine learning in astrophysics

- Feb 2022, *Galaxy Evolution Workshop 2021*, Online (*invited*)
- Sep 2018, *The 2nd Deep Neural Network Workshop*, Seoul, Korea (*invited*)

### Deep-learning study of the 21cm differential brightness temperature during the epoch of reionization

- May 2021, *East Asia SKA Workshop 2021*, Online

### Mock galaxy catalogs in Horizon Run 4 & Multiverse simulations

- Oct 2020, *Korean Astronomical Society Meeting 2020*, Daejeon, Korea (acceptance speech of the *Young Astronomer's Award*)
- Jan 2019, *IMS Workshop 2019*, Seoul, Korea
- Nov 2016, *The 7th KIAS Workshop on Cosmology and Structure Formation*, Seoul, Korea
- Oct 2015, *Korean Astronomical Society Fall Meeting 2015*, Hongcheon, Korea
- Jun 2015, *Innovative Cosmological Simulations with Machine Learning and Statistics in the Era of LSST*, Pittsburgh, USA
- Feb 2009, *SDSS-KSG Winter Workshop*, Jeongseon, Korea

### Repeatability of very-large-scale structures in the Horizon Run 4 simulation

- Apr 2019, *CosKASI Conference 2019—The Correlated Universe*, Jeju, Korea
- Feb 2019, *XVI Tartu-Tuorla Cosmology Meeting*, Tartu, Estonia (*invited*)
- Nov 2018, *The 8th KIAS Workshop on Cosmology and Structure Formation*, Seoul, Korea
- Oct 2018, *Korean Physics Society Fall Meeting 2018*, Changwon, Korea
- Jan 2018, *The 7th Survey Science Group Workshop*, Jeongseon, Korea

### Small-scale features of thermal inflation: CMB distortion, substructure abundance, and 21cm power spectrum

- Apr 2018, *Korean Physic Society Spring Meeting 2018*, Daejeon, Korea
- Jul 2017, *13th International Conference on Gravitation, Astrophysics, and Cosmology*, Seoul, Korea
- Oct 2015, *FRP: The Origin and Evolution of the Universe*, Pohang, Korea

### Concept design of fiber-fed kilo-object spectrograph

- Apr 2017, *CosKASI Conference 2017—Cosmological Quests for the Next Decade*, Daejeon, Korea
- Oct 2016, *Korean Astronomical Society Fall Meeting 2016*, Daejeon, Korea

### Algorithm development for Starbugs: Robotic positioner for MANIFEST

- Feb 2015, *The 3rd Survey Science Group Workshop*, Jeongseon, Korea
- Feb 2014, *The 2nd Survey Science Group Workshop*, Jeongseon, Korea

### Effect of the cosmological constant on the number density of Milky-way-like galaxies

- Nov 2012, *The 5th KIAS Workshop on Cosmology and Structure Formation*, Seoul, Korea (*invited*)
- May 2012, *The KASI-APCTP Joint Mini-workshop on Science and Technology of BigBOSS*, Jeju, Korea
- Feb 2012, *Survey Science Group Workshop*, Jeongseon, Korea
- Jul 2011, *11th RESCEU/DENET Summer School: Dark Energy in the Universe*, Kumamoto, Japan

### Strong accretion shock waves in cluster outskirts and possibility of cosmic ray population inversion

- Nov 2012, *APCTP Workshop on Magnetic Fields in Astrophysics*, Pohang, Korea
- Oct 2012, *Korean Astronomical Society Fall Meeting 2012*, Gwangju, Korea
- Sep 2012, *TRP Mini Workshop on Theories and Practices in Large Scale Structure Formation*, Gwangju, Korea (*invited*)
- Apr 2012, *Korean Astronomical Society Spring Meeting 2012*, Gyeongju, Korea





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## 2D genus topology of 21cm differential brightness temperature during cosmic reionization

- Dec 2011, *APCTP Mini-Workshop on Recent Progresses in Dark Universe and Astro-Particle Physics*, Seoul, Korea
- Feb 2011, *East Asia Young Astronomers Meeting 2011*, Jeju, Korea
- Aug 2010, *10th RESCEU/DENET Summer School: Dark Energy in the Universe*, Kochi, Japan

## Lectures

### Astrobiology

- Fall 2024 – , *University of Science and Technology*, Daejeon & Incheon, Korea

### Astronomical Instrumentation

- Fall 2023, *University of Science and Technology*, Daejeon, Korea

### Modern Astronomy & Cosmology

- Spring 2022 – Fall 2023, *University of Science and Technology*, Daejeon, Korea
- Spring 2020, *University of Seoul*, Seoul, Korea
- Jan 2019 – Sep 2020, *Schools for Korea Astronomical Olympiad*, Goheung & Yangju, Korea

### Astrophysics & Artificial Intelligence

- Feb 2023, *Yonsei University*, Seoul, Korea
- Jul 2020 – Jul 2021, *KIAS Astrophysics Summer School*, Online

### Man, Universe & Civilization

- Fall 2019 – Spring 2020, *University of Seoul*, Seoul, Korea