

# Junhan Kim

## Curriculum Vitae

Cahill Center for Astronomy and Astrophysics  
 California Institute of Technology  
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### EDUCATION

**University of Arizona**, Tucson, Arizona 2013 - 2019  
 Ph.D. Astronomy and Astrophysics  
 Thesis: *Instruments and Statistical Tools to Study Supermassive Black Holes at Event Horizon Scales*  
 Advisor: Prof. Daniel P. Marrone

**Seoul National University**, Seoul, Korea 2006 - 2010  
 B.S. Electrical Engineering  
 B.S. Astronomy

### EMPLOYMENT

**California Institute of Technology**, Pasadena, California 2019 - Present  
 Division of Physics, Mathematics and Astronomy  
 Robert A. Millikan Postdoctoral Scholar in Physics  
 (Faculty Sponsor: Prof. Sunil Golwala)

**University of Arizona**, Tucson, Arizona 2013 - 2019  
 Department of Astronomy and Steward Observatory  
 Graduate Research Assistant

**MTI Co., Ltd.**, Seoul, Korea 2010 - 2013  
 Manufacturing Engineering Team  
 Skilled Industrial Personnel (compulsory military service)

### AWARDS AND HONORS

**Outstanding Ph.D. Thesis Award (Instrumentation)**, Event Horizon Telescope Collaboration 2020

**Robert A. Millikan Prize Postdoctoral Fellowship**, California Institute of Technology 2019

**Certificate of Special Congressional Recognition**, U.S. Senator Martha McSally (Arizona) 2019

**Technology Research Initiative Fund (TRIF) Imaging Fellowship**, University of Arizona 2016

**Antarctic Service Medal**, National Science Foundation 2015

**College of Science Graduate Fellowship**, University of Arizona 2013 - 2014

**Undergraduate Student Scholarship Program**, Korea Foundation for Advanced Studies 2007 - 2010

**Presidential Science Scholarship**, Korea Science and Engineering Foundation 2006 - 2010

**The First Prize in Korea Astronomy Olympiad**, Korean Astronomical Society 2004

Awarded to the Event Horizon Telescope Collaboration:

**Group Achievement Award** (Royal Astronomical Society, 2021), **Nelson P. Jackson Aerospace Award** (National Space Club and Foundation, 2020), **Bruno Rossi Prize** (High Energy Astrophysics Division of the American Astronomical Society, 2020), **Einstein Medal** (Albert Einstein Society Berne, 2020), **Breakthrough Prize in Fundamental Physics** (Breakthrough Prize Foundation, 2019), **NSF Diamond Achievement Award** (National Science Foundation, 2019)

## OBSERVATION AND INSTRUMENTATION EXPERIENCE

**The South Pole Telescope (SPT)**, National Science Foundation (NSF) Amundsen-Scott South Pole Station Event Horizon Telescope (EHT) VLBI receiver deployment (2014-15, 2016-17, 2017-18, 2018-19, 2019-20)

- *Receiver design: Designed submillimeter receiver components including an ortho-mode transducer (polarization splitter) for the receiver. Performed 3D electromagnetic simulations of the components using Computer Simulation Technology (CST) to investigate their operations.*

- *System testing: Tested the receiver system to understand the frequency-dependent noise characteristics of each element and to ensure phase stability. The phase stability test includes tone injection, vector voltmeter measurement, and Allan variance analysis.*

- *Quasi-optical measurement: Characterized the receiver beam pattern using vector beam measurements with the optical elements installed. This work involves designing and installing the beam measurement setup and writing data acquisition and analysis code using MATLAB and python.*

- *Software development: Developed receiver electronics control software in C and the calibration software in python. The calibration software monitors the receiver system during observation and analyzes the measurement data to provide a priori calibration information of the telescope. The software is designed to interact with the telescope control software, Generic Control Program (GCP).*

- *Deployment and observation: Installed and tested the receiver system during four summer seasons at the South Pole, including 345 GHz receiver installation during 2018-19 summer season. Directed the VLBI observation remotely during the April 2017 and April 2018 EHT observing campaigns.*

**The Submillimeter Telescope (SMT)**, Arizona Radio Observatory, University of Arizona  
EHT 1.3 mm VLBI observation (2015, 2016, 2017, 2018)

- *VLBI backend setup: Installed backend digitization and recording system for the VLBI observation. Modified the receiver backend electronics for the VLBI setup. Performed phase stability test through the 230 GHz VLBI signal chain.*

- *Observation: Led the EHT observation including the official runs and VLBI fringe tests with the APEX telescope at Chile (April 2015's 345 GHz test, November 2016's 230 GHz test). Derived the telescope pointing offset rms repeatability for VLBI sources.*

**Subaru Telescope**, National Astronomical Observatory of Japan

“Composition of Flora Asteroidal Family Comet-P/2010 A2” (Code: S11A-038, Suprime-Cam)

## JOINT PROPOSALS

**The Atacama Large Millimeter/submillimeter Array (ALMA)**

Cycle 6, “Imaging the Shadow of a Supermassive Black Hole: Event Horizon Telescope Observations of Sgr A\*” (Code: 2018.1.01159.V)

Cycle 5, “The light-day scale structure of an extragalactic jet: 1 mm VLBI observations of Centaurus A” (Code: 2017.1.01181.V)

Cycle 5, “Imaging the Black Hole Shadow and Jet Launching Region of M87” (Code: 2017.1.00841.V)

Cycle 5, “Imaging the Shadow of a Supermassive Black Hole: Event Horizon Telescope Observations of Sgr A\*” (Code: 2017.1.00797.V)

Cycle 5, “Imaging the Global Accretion and Outflow of Sgr A\*: 3 mm VLBI with GMVA+ALMA” (Code: 2017.1.00795.V)

## TEACHING EXPERIENCE

**University of Arizona**

Lab Mentor

2015 - 2019

- *advised undergraduate research assistants of Dan Marrone's radio instrumentation lab.*

Teaching Assistant, ASTR 202: Life in the Universe (Department of Astronomy)

Fall 2018

Teaching Assistant, ASTR 202: Life in the Universe (Department of Astronomy)

Fall 2015

**Seoul National University**

Teaching Assistant, Physics Tutoring Program (College of Engineering)

Spring 2010

Teaching Assistant, Basic Physics (Department of Physics &amp; Astronomy)

Spring 2008

**SERVICE**

Reviewer, Future Investigators in NASA Earth and Space Science and Technology (FINESST) 2020, 2021  
 Travel Grants Judge, Graduate & Professional Student Council (GPSC), University of Arizona 2017  
 Coordinator, Graduate Mentoring Program, Department of Astronomy, University of Arizona 2016  
 Graduate Student Council, Department of Astronomy, University of Arizona 2015 - 2017

**OUTREACH**

## Public Talks

- "Seeing the Invisible: Studying Black Holes with the Event Horizon Telescope" Dec. 2019  
 MAUNAKEA SKIES Astronomy Talk Series, 'Imiloa Astronomy Center, Hilo, HI  
 - "Studying Black Holes from the South Pole" Nov. 2019  
 American Institute of Aeronautics & Astronautics, Los Angeles - Las Vegas Section, Los Angeles, CA  
 - "The Event Horizon Telescope: Studying Black Holes from the South Pole" Feb. 2018  
 Sunday Science Lecture, NSF Amundsen-Scott South Pole Station, Antarctica

## Documentary Filming

- *Filmed South Pole deployments for documentaries, including Space's Deepest Secrets Season 2 (Discovery Science, April 2017), Anthony Bourdain: Parts Unknown (CNN, June 2017), How to See a Black Hole: The Universe's Greatest Mystery (BBC Four, April 2019).*

**PROFESSIONAL DEVELOPMENT**

The Collaboration for Astronomy Signal Processing and Electronics Research (CASPER) Workshop, Pasadena, CA Aug. 2017  
 Summer School in Statistics for Astronomers XII, Penn State University, PA May 2016  
 National Radio Astronomy Observatory Synthesis Imaging Workshop, Socorro, NM May 2014  
 Agilent Measurement Forum (AMF), Seoul, Korea Mar. 2011

**TALKS AND PRESENTATIONS**

"The Event Horizon Telescope: Studying Black Holes from the South Pole" Feb. 2020  
 Observational Cosmology Seminar, Caltech  
 "First M87 Event Horizon Telescope Results: Array and Instrumentation" Jan. 2020  
 The 235th American Astronomical Society Meeting, Honolulu, HI  
 "Instruments and Statistical Tools to Study Supermassive Black Holes at Event Horizon Scales" Jan. 2020  
 The 235th American Astronomical Society Meeting, Honolulu, HI  
 "Instruments and Statistical Tools to Study Supermassive Black Holes at Event Horizon Scales" Nov. 2019  
 High Energy & Astro Particle (HEAP) Seminar, University of California, Los Angeles (UCLA)  
 "First Event Horizon Telescope Results: M87" Apr. 2019  
 Kavli Institute for Cosmological Physics Friday Noon Seminar, University of Chicago  
 "A VLBI receiving system for the South Pole Telescope" Sept. 2018  
 Korea Astronomy and Space Science Institute (KASI)-Korea Polar Research Institute (KOPRI)  
 Workshop for Antarctic Scientific Research Collaboration, Korea

- “A VLBI receiving system for the South Pole Telescope” (poster) Jun. 2018  
SPIE Astronomical Telescopes + Instrumentation: Millimeter, Submillimeter, and Far-Infrared  
Detectors and Instrumentation for Astronomy IX, Austin, TX
- “Tilted beam measurement of VLBI receiver for the South Pole Telescope” (poster) Mar. 2018  
29th IEEE International Symposium on Space THz Technology (ISSTT), Pasadena, CA
- “Observatory readiness: The Submillimeter Telescope (SMT) and the South Pole Telescope (SPT)” Mar. 2017  
Event Horizon Telescope Operational Readiness Review, Cambridge, MA
- “Bayesian Techniques for Comparing Time-dependent GRMHD Simulations to Variable  
Event Horizon Telescope observations” Nov. 2016  
Event Horizon Telescope 2016, Cambridge, MA
- “Incorporating the South Pole Telescope into the Event Horizon Telescope” Jan. 2016  
Korea Astronomy and Space Science Institute (KASI), Daejeon, Korea
- “Bayesian Techniques for Comparing Time-dependent GRMHD Simulations to Variable  
Event Horizon Telescope observations” Dec. 2015  
Theoretical and Computational Astrophysics Networks (TCAN) meeting, Tucson, AZ
- “Incorporating the South Pole Telescope into the Event Horizon Telescope” Aug. 2015  
Korea Institute for Advanced Study (KIAS), Seoul, Korea
- “Reflectance Spectrum of Main Belt Asteroid P/2010 A2” Apr. 2011  
Korean Astronomical Society Meeting, Korea

# Junhan Kim

## List of Publications

### First Author Publications

5. “Tilted beam measurement of VLBI receiver for the South Pole Telescope”  
**Kim, J.**, & Marrone, D. P.  
 2018, *Proceedings of the 29th International Symposium on Space Terahertz Technology*, 159-163.  
 (<http://www.nrao.edu/meetings/issst/papers/2018/2018159163.pdf>)
4. “The 1.4 mm core of Centaurus A: First VLBI results with the South Pole Telescope”  
**Kim, J.**, Marrone, D. P., Roy, A. L., Wagner, J., Asada, K., Beaudoin, C., Blanchard, J., Carlstrom, J. E., Chen, M.-T., Crawford, T. M., Crew, G. B., Doeleman, S. S., Fish, V. L., Greer, C. H., Gurwell, M. A., Henning, J. W., Inoue, M., Keisler, R., Krichbaum, T. P., Lu, R.-S., Muders, D., Müller, C., Nguyen, C. H., Ros, E., SooHoo, J., Tilanus, R. P. J., Titus, M., Vertatschitsch, L., Weintroub, J., & Zensus, J. A.  
 2018, *The Astrophysical Journal*, 861, 129  
 (<http://iopscience.iop.org/article/10.3847/1538-4357/aac7c6>)
3. “A VLBI receiving system for the South Pole Telescope”  
**Kim, J.**, Marrone, D. P., Beaudoin, C., Carlstrom, J. E., Doeleman, S. S., Folkers, T. W., Forbes, D., Greer, C. H., Lauria, E. F., Massingill, K. D., Mayer, E., Nguyen, C. H., Reiland, G., SooHoo, J., Stark, A. A., Vertatschitsch, L., Weintroub, J., & Young, A.  
 2018, *Proceedings of SPIE*, 10708, 107082S  
 (<http://doi.org/10.1117/12.2301005>)
2. “Bayesian Techniques for Comparing Time-dependent GRMHD Simulations to Variable Event Horizon Telescope Observations”  
**Kim, J.**, Marrone, D. P., Chan, C.-K., Medeiros, L., Özel, F., & Psaltis, D.  
 2016, *The Astrophysical Journal*, 832, 156  
 (<http://iopscience.iop.org/article/10.3847/0004-637X/832/2/156>)
1. “Multiband Optical Observation of the P/2010 A2 Dust Tail”  
**Kim, J.**, Ishiguro, M., Hanayama, H., Hasegawa, S., Usui, F., Yanagisawa, K., Sarugaku, Y., Watanabe, J., & Yoshida, M.  
 2012, *The Astrophysical Journal Letters*, 746, L11  
 (<http://iopscience.iop.org/article/10.1088/2041-8205/746/1/L11>)

### Secondary Author Publications

24. “The Polarized Image of a Synchrotron-emitting Ring of Gas Orbiting a Black Hole”  
 Narayan, R. et al., including **Kim, J.**, 2021, *The Astrophysical Journal*, 912, 35  
 (<https://iopscience.iop.org/article/10.3847/1538-4357/abf117>)
23. “Broadband Multi-wavelength Properties of M87 during the 2017 Event Horizon Telescope Campaign”  
 The Event Horizon Telescope Collaboration Multi-wavelength Science Working Group et al., including **Kim, J.**,  
 2021, *The Astrophysical Journal Letters*, 911, L11  
 (<https://iopscience.iop.org/article/10.3847/2041-8213/abef71>)
22. “Polarimetric Properties of Event Horizon Telescope Targets from ALMA”  
 Goddi, C. et al., including **Kim, J.**, 2021, *The Astrophysical Journal Letters*, 910, L14  
 (<https://iopscience.iop.org/article/10.3847/2041-8213/abee6a>)

21. “First M87 Event Horizon Telescope Results. VIII. Magnetic Field Structure near The Event Horizon”  
The Event Horizon Telescope Collaboration et al., including **Kim, J.**, 2021, *The Astrophysical Journal Letters*, 910, L13  
(<https://iopscience.iop.org/article/10.3847/2041-8213/abe4de>)
20. “First M87 Event Horizon Telescope Results. VII. Polarization of the Ring”  
The Event Horizon Telescope Collaboration et al., including **Kim, J.**, 2021, *The Astrophysical Journal Letters*, 910, L12  
(<https://iopscience.iop.org/article/10.3847/2041-8213/abe71d>)
19. “Gravitational Test beyond the First Post-Newtonian Order with the Shadow of the M87 Black Hole”  
Psaltis, D. et al., including **Kim, J.**, 2020, *Physical Review Letters*, 125, 141104  
(<https://journals.aps.org/prl/abstract/10.1103/PhysRevLett.125.141104>)
18. “Monitoring the Morphology of M87\* in 2009–2017 with the Event Horizon Telescope”  
Wielgus, M. et al., including **Kim, J.**, 2020, *The Astrophysical Journal*, 901, 67  
(<https://iopscience.iop.org/article/10.3847/1538-4357/abac0d>)
17. “Verification of Radiative Transfer Schemes for the EHT”  
Gold, R. et al., including **Kim, J.**, 2020, *The Astrophysical Journal*, 897, 148  
(<https://iopscience.iop.org/article/10.3847/1538-4357/ab96c6>)
16. “Event Horizon Telescope imaging of the archetypal blazar 3C 279 at an extreme 20 microarcsecond resolution”  
Kim, J.-Y. et al., including **Kim, J.**, 2020, *Astronomy & Astrophysics*, 640, A69  
(<https://doi.org/10.1051/0004-6361/202037493>)
15. “SYMBA: An end-to-end VLBI synthetic data generation pipeline”  
Roelofs, F. et al., including **Kim, J.**, 2019, *Astronomy & Astrophysics*, 636, A5  
(<https://doi.org/10.1051/0004-6361/201936622>)
14. “The Event Horizon General Relativistic Magnetohydrodynamic Code Comparison Project”  
Porth, O. et al., including **Kim, J.**, 2019, *The Astrophysical Journal Supplement Series*, 243, 26  
(<https://iopscience.iop.org/article/10.3847/1538-4365/ab29fd>)
13. “First M87 Event Horizon Telescope Results. VI. The Shadow and Mass of the Central Black Hole”  
The Event Horizon Telescope Collaboration et al., including **Kim, J.**, 2019, *The Astrophysical Journal Letters*, 875, L6  
(<https://iopscience.iop.org/article/10.3847/2041-8213/ab1141>)
12. “First M87 Event Horizon Telescope Results. V. Physical Origin of the Asymmetric Ring”  
The Event Horizon Telescope Collaboration et al., including **Kim, J.**, 2019, *The Astrophysical Journal Letters*, 875, L5  
(<https://iopscience.iop.org/article/10.3847/2041-8213/ab0f43>)
11. “First M87 Event Horizon Telescope Results. IV. Imaging the Central Supermassive Black Hole”  
The Event Horizon Telescope Collaboration et al., including **Kim, J.**, 2019, *The Astrophysical Journal Letters*, 875, L4  
(<https://iopscience.iop.org/article/10.3847/2041-8213/ab0e85>)
10. “First M87 Event Horizon Telescope Results. III. Data Processing and Calibration”  
The Event Horizon Telescope Collaboration et al., including **Kim, J.**, 2019, *The Astrophysical Journal Letters*, 875, L3  
(<https://iopscience.iop.org/article/10.3847/2041-8213/ab0c57>)
9. “First M87 Event Horizon Telescope Results. II. Array and Instrumentation”  
The Event Horizon Telescope Collaboration et al., including **Kim, J.**, 2019, *The Astrophysical Journal Letters*, 875, L2  
(<https://iopscience.iop.org/article/10.3847/2041-8213/ab0c96>)

8. “First M87 Event Horizon Telescope Results. I. The Shadow of the Supermassive Black Hole”  
The Event Horizon Telescope Collaboration et al., including **Kim, J.**, 2019, *The Astrophysical Journal Letters*, 875, L1  
(<https://iopscience.iop.org/article/10.3847/2041-8213/ab0ec7>)
7. “Detection of Intrinsic Source Structure at  $\sim 3$  Schwarzschild Radii with Millimeter-VLBI Observations of Sagittarius A\*”  
Lu, R.-S. et al., including **Kim, J.**, 2018, *The Astrophysical Journal*, 859, 60  
(<http://iopscience.iop.org/article/10.3847/1538-4357/aabe2e>)
6. “GRMHD Simulations of Visibility Amplitude Variability for Event Horizon Telescope Images of Sgr A\*”  
Medeiros, L. et al., including **Kim, J.**, 2018, *The Astrophysical Journal*, 856, 163  
(<http://iopscience.iop.org/article/10.3847/1538-4357/aab204>)
5. “Variability in GRMHD simulations of Sgr A\*: Implications for EHT closure phase observations”  
Medeiros, L. et al., including **Kim, J.**, 2017, *The Astrophysical Journal*, 844, 35  
(<http://iopscience.iop.org/article/10.3847/1538-4357/aa7751>)
4. “Persistent Asymmetric Structure of Sagittarius A\* on Event Horizon Scales”  
Fish, V. L. et al., including **Kim, J.**, 2016, *The Astrophysical Journal*, 820, 90  
(<http://iopscience.iop.org/article/10.3847/0004-637X/820/2/90>)
3. “Comet 17P/Holmes: Contrast in Activity between Before and After the 2007 Outburst”  
Ishiguro, M. et al., including **Kim, J.**, 2013, *The Astrophysical Journal*, 778, 19  
(<http://iopscience.iop.org/article/10.1088/0004-637X/778/1/19>)
2. “Interpretation of (596) Scheila’s Triple Dust Tails”  
Ishiguro, M. et al., including **Kim, J.**, 2011, *The Astrophysical Journal Letters*, 741, L24  
(<http://iopscience.iop.org/article/10.1088/2041-8205/741/1/L24>)
1. “Observational Evidence for an Impact on the Main-Belt Asteroid (596) Scheila”  
Ishiguro, M. et al., including **Kim, J.**, 2011, *The Astrophysical Journal Letters*, 740, L11  
(<http://iopscience.iop.org/article/10.1088/2041-8205/740/1/L11>)

#### Book

1. “Exploring the Universe from the South Pole” – A popular science book written in Korean. Asia Pacific Center for Theoretical Physics (APCTP)’s science book of the year 2020.  
**Kim, J.**, & Kang, J. 2019, Sigongsa  
(<https://www.sigongsa.com/books/bookView.php?bookcode=SB006624>)