

# Kunio M. Sayanagi

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## Education:

Ph.D. in Physics (2007)  
University of Arizona

M.S. in Physics (2004)  
University of Arizona

B.S. in Liberal Arts (2000)  
Juniata College

## Invited Review Articles:

1. Sanchez-Lavega, A., Fischer, G., Fletcher, L.N., Garcia-Melendo, E., Hesman, B., Perez-Hoyos, S., Sayanagi, K.M., and Sromovsky, L.A., 2018, “*Great Saturn Storm of 2010-2011*” Chapter in: *Saturn in the 21st Century*, p.377-416. Cambridge Univ. Press. ISBN: 978-1107106772
2. Sayanagi, K.M., Baines, K.H., Dyudina, U.A., Fletcher, L.N., Sanchez-Lavega, A., West, R.A., 2018, “*Saturn’s Polar Atmosphere*” Chapter in: *Saturn in the 21st Century*, p.337-376. Cambridge Univ. Press. ISBN: 978-1107106772
3. Squyres, S. et al., 2011, “*Vision and Voyages for Planetary Science in the Decade 2013-2022.*” Planetary Science Decadal Survey, Space Studies Board, National Academies Press. ISBN-10: 0-309-22464-0

## Peer-Reviewed Publications:

1. Brueshaber, S.B., Sayanagi, K.M. and Dowling, T.E., 2019 “*Dynamical regimes of giant planet polar vortices.*” *Icarus* 323, p. 46-61
2. Gunnarson, J.L., Sayanagi, K.M. and 5 Co-authors, 2018. “*Saturn’s new ribbons: Cassini observations of planetary waves in Saturn’s 42N atmospheric jet.*” *Geophysical Research Letters* 45, p.7399-7408
3. Ingersoll, A. P., Ewald, S.P., Sayanagi, K. M. and Blalock, J. J., 2018 “*Saturn’s Atmosphere at 1-10 Kilometer Resolution.*” *Geophysical Research Letters* 45, p7851-7856
4. Del Rio-Gaztelurrutia, T. and 12 Co-Authors, 2018. “*A Planetary-Scale Disturbance in a Long Living Three Vortex Coupled System in Saturn’s Atmosphere,*” *Icarus* 302, p.499-513
5. Hueso, R. and 30 Co-Authors. 2017. “*Neptune long-lived Atmospheric Features in 2013-2015 from Small (28 cm) and Large (10m) Telescopes,*” *Icarus* 295 p89-109
6. Sayanagi, K.M., Blalock, J.J., Dyudina, U.A., Ewald, S.P., and Ingersoll, A.P., 2017. “*Cassini ISS Observation of Saturn’s North Polar Vortex and Comparison to the South Polar Vortex.*” *Icarus* 285, p.68-82.
7. Cosentino, R.G., Simon, A.A., Morales-Juberias R., Sayanagi, K.M. 2015. “*Observations and Numerical Modelling of the Jovian Ribbon,*” *Astrophysical Journal Letters* 810, L10.
8. Morales-Juberías, R., Sayanagi, K.M., Simon, A.A., Fletcher, L.N., Cosentino, R.G. 2015, “*Meandering Shallow Atmospheric Jet as a Model of Saturn’s North-polar Hexagon,*” *Astrophys. J. Lett.* 806, L18.
9. de Pater, I., Sromovsky, L.A., Fry, P.M., Hammel, H.B., Baranec, C. and Sayanagi, K.M., 2015, “*Record-breaking storm activity on Uranus in 2014*”, *Icarus*, Vol 252, p.121–128
10. Fischer, G., Ye, S.-Y. Ye, J.B. Groene, A.P. Ingersoll, K.M. Sayanagi, J.D. Menietti, W.S. Kurth, and D.A. Gurnett, 2014, “*A possible influence of the Great White Spot on Saturn kilometric radiation periodicity.*” *Annales Geophysicae*, Vol 32, P.1463-1476.
11. Arridge, C.S. et al. 2014, “*The science case for an orbital mission to Uranus: Exploring the origins and evolution of ice giant planets.*” *Planetary and Space Sciences*, Vol. 104, p. 122-140
12. Sayanagi, K.M., Dyudina, U.A., Ewald, S.P., Muro, G.D., and Ingersoll, A.P., 2014. “*Cassini ISS Observation of Saturn’s String of Pearls*” *Icarus*, Vol 229, p.170-180.
13. Sayanagi, K.M., and 8 co-authors, 2013. “*Dynamics of Saturn’s Great Storm of 2010-2011 from Cassini ISS and RPWS*” *Icarus*, 223, p. 460-478.

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### Peer-Reviewed Publications (continued):

14. Diniega, S., Sayanagi, K.M. and 18 co-authors. 2013. "Mission to the Trojan Asteroids: lessons learned during a JPL Planetary Science Summer School Mission Design Exercise," *Planetary & Space Science*, 76, p. 68-82
15. Christophe, B. et al., 2012, "OSS: an Outer Solar System Mission towards Neptune, Triton and KBO" *Experimental Astronomy*, 34, pp.203-242
16. Barnes, J.W. et al., 2012, "AVIATR – Aerial Vehicle for In-Situ and Airborne Titan Reconnaissance" *Experimental Astronomy* Vol. 33, p.55-127
17. Arridge, C.S. et al., 2011 "Uranus Pathfinder: Exploring the Origins and Evolution of Ice Giant Planets" *Experimental Astronomy*, Vol.33, pp. 753-791
18. Morales-Juberias, R., Sayanagi, K. M., Ingersoll, A. P. and Dowling, T. E., 2011. "Emergence of Polar-Jet Polygons from Jet Instabilities in a Saturn Model" *Icarus*. Vol. 211, Issue 2, p. 1284-1293
19. Sayanagi, K. M., Morales-Juberias, R., and Ingersoll, A. P., 2010, "Saturn's Northern Hemisphere Ribbon: Simulations and Comparison with the Meandering Gulf Stream" *Journal of Atmospheric Sciences*. Vol. 67, Issue 8, p.2658-2678
20. Sayanagi, K. M., Showman, A. P. and Dowling, T. E., 2008, "The emergence of multiple robust zonal jets from freely evolving, three-dimensional stratified geostrophic turbulence with applications to Jupiter." *Journal of Atmospheric Sciences*. Vol. 65, Issue 12, p.3947–3962.
21. Sayanagi, K.M. and Showman, A.P. 2007, "Effects of a Large Convective Storm on Saturn's Equatorial Jet," *Icarus*, Volume 187, Issue 2, p. 520-539

### Whitepapers and Reports:

1. Sayanagi, K. M. et al. 2019. "Small Next-generation Atmospheric Probe (SNAP) Concept Study to Enable Future Multi-Probe Missions to Saturn, Uranus and Neptune: Final Report." NASA Planetary Science Deep Space SmallSat Studies (PSDS3) Mission Concept Study Report.
2. Wong, M. H. et al. 2018 "Solar system Deep Time-Surveys of atmospheres, surfaces, and rings." Astro2020 Science Whitepaper, Space Studies Board, National Academies of Sciences
3. Chanover, N. et al. 2018 "Triggered High-Priority Observations of Dynamic Solar System Phenomena." Astro2020 Science Whitepaper, Space Studies Board, National Academies of Sciences
4. Rymer, A. et al. 2018. "Solar System Ice Giants: Exoplanets in our Backyard." Exoplanet Science Strategy Whitepaper, Space Studies Board, National Academies of Sciences
5. Sayanagi, K.M. 2017. "Saturn's Polar Hexagon," *Nature Astronomy* 1, p.584
6. Spilker, T. et al. 2010, "Saturn Atmospheric Entry Probe Mission Study," *NASA Report to the Planetary Decadal Survey 2013-2023*
7. Spilker, T. et al. 2010, "Saturn Atmospheric Entry Probe Trade Study," *NASA Report to the Planetary Decadal Survey 2013-2023*
8. Agnor, C. et al. 2009, "The Exploration of Neptune and Triton." National Research Council Planetary Decadal Survey 2013-2023 White Paper.
9. Fletcher, L.N. et al. "Jupiter Atmospheric Science in the Next Decade." National Research Council Planetary Decadal Survey 2013-2023 White Paper.
10. Wesley, A. et al. 2009, "Ground-Based Support for Solar-System Exploration: Continuous Coverage Visible Light Imaging of Solar System Objects from a Network of Ground-Based Observatories." National Research Council Planetary Decadal Survey 2013-2023 White Paper.
11. Fletcher, L.N. et al. 2009, "Jupiter Atmospheric Science in the Next Decade." National Research Council Planetary Decadal Survey 2013-2023 White Paper.

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### Whitepapers and Reports (continued):

12. Orton, G.S. et al. 2009, “*Earth-Based Observational Support for Spacecraft Exploration of Outer-Planet Atmospheres.*” National Research Council Planetary Decadal Survey Whitepaper.
13. Orton, G.S. et al. 2009, “*Saturn Atmospheric Science in the Next Decade.*” National Research Council Planetary Decadal Survey 2013-2023 White Paper.
14. Wong, M.H. et al. 2009, “*A Dedicated Space Observatory for Time-Domain Solar System Science.*” National Research Council Planetary Decadal Survey 2013-2023 White Paper.
15. Sayanagi, K.M., 2008, “*Under Jupiter’s Pulsing Skin,*” Nature 451, Issue 7177, p. 409-410
16. Sayanagi, K.M. contributed as a Science Writer at *Ars Technica*:  
<http://arstechnica.com/author/kunio-m-sayanagi-2/>

### Invited Conference Presentations (Since 2012):

1. Sayanagi, K. M., Simon, A. A., Hofstadter, M. D., Stern, S. A. 2019. “*Science Objectives of Ice Giant – KBO Exploration.*” *Symposium on Planetary Science*, Sendai, Japan.
2. Sayanagi, K. M. et al. 2018. “*Small Next-generation Atmospheric Probe.*” *NASA Goddard Space Flight Center Planetary CubeSats Symposium.*
3. Sayanagi, K. M. 2018. “*Giant Planet Atmospheric Sciences: Review and Future Vision.*” *Symposium on Planetary Science*, Sendai, Japan
4. Sayanagi, K. M. 2018 “*Small Next-generation Atmospheric Probe.*” National Society for Black Physicists Conference
5. Sayanagi, K.M., 2014, “*Future of Planetary Astronomy: Need for a Post-Hubble Visible/UV Space Telescope*” Forum for New Leaders in Space Science, National Academy of Sciences/Chinese Academy of Science, Beijing, China
6. Sayanagi, K. M. et al 2014, “*Cassini ISS Observation of Saturn’s North Polar Vortex and the Hexagon*”, Asia-Oceania GeoSciences Society Meeting PS08-11-A013, Sapporo, Japan
7. Sayanagi, K. M. et al. 2014, “*Polar Atmosphere of Saturn*”, Saturn in the 21<sup>st</sup> Century Conference, Madison, WI.

### Conference Presentations (2019):

1. Sayanagi, K. M. and 9 Co-authors. “*Small Next-generation Atmospheric Probe (SNAP) for In-Situ Atmospheric Exploration of Ice Giant Planets.*” European Geophysical Union EGU2019-6210
2. Sayanagi, K. M. and 7 Co-authors. “*Small Next-generation Atmospheric Probe (SNAP) for In-Situ Atmospheric Exploration of Ice Giant Planets.*” Workshop on In-Situ Exploration of the Gas Giants, Marseille, France
3. Sayanagi, K. M. “*Planning for the US Planetary Science Decadal Survey.*” *Symposium on Planetary Science*, Sendai, Japan

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### Conference Presentations (2018):

1. McCabe, R. M. and 8 Co-authors. “*Observational Analysis of Venusian Atmospheric Equatorial Waves and Superrotation.*” American Geophysical Union, Fall Meeting 2018, abstract #P51F-2936
2. Brueshaber S. B., Sayanagi, K. M. and Dowling, T. E. “*Polar Vortex Dynamics on Gas and Ice Giant Planets.*” American Geophysical Union, Fall Meeting 2018, abstract #P43E-3817
3. Blalock, J. J. and 8 Co-authors. “*Seasonal Analysis of Saturn's Clouds, Colors, and Winds from Cassini ISS.*” American Geophysical Union, Fall Meeting 2018, abstract #P43E-3816
4. Ingersoll, A. P. and 3 Co-authors. “*Saturn's atmosphere at 1-10 kilometer resolution: Cassini imaging during the final year.*” American Geophysical Union, Fall Meeting 2018, abstract #P43E-3815
5. Sayanagi, K. M. and 27 Co-Authors. “*SNAP: Small Next-generation Atmospheric Probe Concept.*” American Geophysical Union, Fall Meeting 2018, abstract #P33E-3873
6. McCabe, R. M. and 8 Co-authors, “*Observational Analysis of Venusian Atmospheric Equatorial Waves and Superrotation.*” Venus Exploration and Analysis Group Meeting, LPI Contribution No. 2137, id.8042
7. Gunndarson, J. L. and 6 Co-authors. “*Atmospheric Dynamics in the Aftermath of Saturn's Great Storm.*” American Astronomical Society, DPS meeting #50, id.507.04
8. Brueshaber, S., Sayanagi, K. M. and Dowling, T. E. “*Dynamical Regimes of Giant Planet Polar Vortices from Shallow Water Modeling.*” American Astronomical Society, DPS meeting #50, id.507.02
9. Blalock J. J. and 6 Co-Authors. “*Jupiter's Global Zonal Winds as Measured from New Horizons LORRI Images*” American Astronomical Society, DPS meeting #50, id.503.05
10. Gallego, A. R. and 3 Co-authors. “*Analysis of Wind and Clouds on Jupiter using the Cassini Spacecraft Visible and Near-Infrared Camera Images.*” American Astronomical Society, DPS meeting #50, id.214.06
11. Garland, J. and 4 Co-authors. “*Jupiter's Cloud Morphology Spatial Structure and Cloud-top Wind Fields from New Horizons and Juno.*” American Astronomical Society, DPS meeting #50, id.214.05
12. Sayanagi, K. M. and 13 Co-authors. “*Undergraduate Astronomy Research and Education through Observation of Jupiter Impact Flashes to Characterize Small-Body Populations in the Outer Solar System.*” American Astronomical Society, DPS meeting #50, id.211.06
13. Sayanagi, K. M. and 27 Co-authors. “*SNAP: Small Next-generation Atmospheric Probe Concept.*” American Astronomical Society, DPS meeting #50, id.114.09
14. McCabe, R. M. and 9 Co-authors, “*Observational Analysis of Venusian Atmospheric Equatorial Waves and Superrotation.*” American Astronomical Society, DPS meeting #50, id.102.05
15. Atkinson, D. H. and 9 Co-authors, “*SNAP - the Small Next-generation Atmospheric Probe Concept for Future Ice Giant Missions.*” European Planetary Science Congress EPSC2018-71
16. Baines, K. H. and 6 Co-Authors, “*Cassini at Jupiter and Saturn: New results on storms and clouds as obtained from the ISS filter imager and VIMS mapping spectrometer,*” Asia Oceana Geoscience Society Meeting, PS06-A017, Honolulu, Hawaii
17. Sayanagi, K. M. and 26 Co-authors, “*Small Next-generation Atmospheric Probe (SNAP) Concept for In-Situ Atmosphere Exploration of Uranus and/or Neptune*” Japan Geosci. Union PPS01-P07
18. Sayanagi, K. M. and 8 Co-authors, “*Seasonal Atmospheric Evolution of Saturn Observed by Cassini Spacecraft; New Results from ISS Imager and VIMS Mapping Spectrometer.*” Japan Geoscience Union Meeting Abstract PPS01-11
19. Atkinson, D.H. and 8 Co-authors. “*Small Next-generation Atmospheric Probe (SNAP) Concept for Ice Giant Missions*” European Geophysical Union General Assembly
20. Sayanagi, K. M. and 26 Co-authors, “*Small Next-Generation Atmospheric Probe (SNAP) Concept for Ice Giant Missions*” Lunar and Planetary Science Conference LPI Contribution No. 2083, id.2262
21. Sayanagi, K. M. 2018. “*Building Linkage with Planetary Decadal Survey of USA.*” *Symposium on Planetary Science*, Sendai, Japan

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### Conference Presentations (2017):

1. Blalock, J.J., Sayanagi, K.M. and 7 Co-Authors, "Cassini ISS Observation of Saturn from Grand Finale Orbits," AGU Fall Meeting P11G-08
2. Sayanagi, K.M., and 8 Co-Authors, "SNAP: Small Next-generation Atmospheric Probe Concept," AGU Fall Meeting P31D-2851
3. McCabe, R.M., Gunnarson, J.L., Sayanagi, K.M. and 6 Co-Authors, "Analysis of Venusian Atmospheric Two-Dimensional Winds and Features Using Venus Express, Akatsuki, and Ground-Based Images," American Astronomical Society, DPS meeting #49, id.#422.02.
4. Atkinson, D.H., Sayanagi K.M. and 7 Co-Authors, "The Small Next-generation Atmospheric Probe (SNAP) for Exploration of the Ice Giants - A PSDS3 Mission Concept Study," American Astronomical Society, DPS meeting #49, id.#219.21.
5. Garland, J., Sayanagi, K.M. and 6 Co-Authors, "Comparison of the Cloud Morphology Spatial Structure Between Jupiter and Saturn Using JunoCam and Cassini ISS," American Astronomical Society, DPS meeting #49, id.#118.01.
6. Blalock, J.J., Sayanagi, K.M., and 7 Co-Authors, "Dynamics and Morphology of Saturn's North Polar Region During Cassini's Final Year," American Astronomical Society, DPS meeting #49, id.# 205.11.
7. Gunnarson, J.L., Sayanagi K.M. and 7 Co-Authors, "Dynamics and Characteristics of Saturn's Ribbon Wave Using Cassini Images," American Astronomical Society, DPS meeting #49, id.#115.27.
8. del Río-Gaztelurrutia and 13 Co-Authors, "A planetary-scale disturbance in a long-living three-vortex coupled system in Saturn's atmosphere," European Planetary Science Congress Vol. 11, EPSC2017-434, 2017
9. Atkinson, D.H., Sayanagi, K.M. and 7 Co-Authors, "Small Next-generation Atmospheric Probe (SNAP) Concept," European Planetary Science Congress Vol 11, EPSC2017-306-1, 2017.
10. Sayanagi, K.M. and 8 Co-Authors, "Small Next-generation Atmospheric Probe Concept (SNAP)," Outer Planets Assessment Group Meeting, September 2017
11. Sayanagi, K.M., "SNAP: Small Next-generation Atmospheric Probe," Low-Cost Planetary Missions Conference, <https://www.lcpm12.org>
12. Sayanagi, K.M. and 7 Co-Authors, "Small Next-generation Atmospheric Probe Concept (SNAP)," International Planetary Probe Workshop, <https://solarsystem.nasa.gov/missions/ippw>
13. Sayanagi, K.M. and 16 Co-Authors, "Two-Stage Saturn Probe to Explore 60+ Bar Atmosphere," International Planetary Probe Workshop, <https://solarsystem.nasa.gov/missions/ippw>
14. Sayanagi, K.M., and 8 Co-Authors, Small Next-generation Atmospheric Probe Concept (SNAP), Japan Geoscience Union Meeting 2017 Abstract PPS01-P02.
15. McCabe, R.M., Sayanagi, K.M., and 7 Co-Authors, Temporal Evolution of the Venusian Atmospheric Superrotation Measured in the Venus Express Venus Monitoring Camera Data, Japan Geoscience Union Meeting 2017 Abstract PPS06-P03.
16. Sayanagi, K.M., Blalock, J.J., Dyudina, U.A., Ewald, S.P., Ingersoll, A.P., "View of Saturn from Cassini Grand Finale Orbits," Japan Geoscience Union Meeting 2017 Abstract PPS01-P11.
17. Sayanagi, K.M., Dillman, R.A., Atkinson, D., Simon, A., Wong, M.H., Spilker, T. Saikia, S., Li, J. "Small Next-generation Atmospheric Probe Concept," Outer Planets Assessment Group Meeting, February 2017.
18. McEwen, A. and 17 Co-authors, "Vision for Exploring the Outer Solar System," Planetary Science Vision 2050 Workshop, LPI Contribution No. 1989, id.8140

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### Conference Presentations (2016):

1. Sayanagi, K.M., Blalock, J., Fletcher, L.N., Ingersoll, A.P., Dyudina, U., Ewald, S.P., Summer at Saturn's North Pole: Seasonal Changes Seen by ISS & CIRS on Cassini, and VLT on the Ground, AGU Fall Meeting P33B-2137
2. Blalock, J., Sayanagi, K.M., Fletcher, L.N., Ingersoll, A.P., Dyudina, U., Ewald, S.P., Analysis of Saturn's Hexagon between 2012 and 2016: Dynamical and Morphological Changes, AGU Fall Meeting P33D-06
3. Sayanagi, K.M., Blalock, J.J., Ingersoll, A.P., Dyudina, U.A., Ewald, S.P., Formation of a Bright Polar Hood over the Summer North Pole of Saturn in 2016, American Astronomical Society, DPS meeting #48, id.#501.03
4. Rathbun, J., Castillo-Rogez, J., Diniega, S. Hurley, D., New, M., Pappalardo, R.T., Prockter, L., Sayanagi, K.M., Schug, J., Turtle, E.P., Vasavada, A.R., Historical Trends of Participation of Women Scientists in Robotic Spacecraft Mission Science Teams: Effect of Participating Scientist Programs, American Astronomical Society, DPS meeting #48, id.#332.01
5. McCabe, R.M., Sayanagi, K.M., Blalock, J.J., Peralta, J., Gray, C.L., McGouldrick, K., Imamura, T. Analysis of Venusian Zonal Winds Using Venus Express Data, American Astronomical Society, DPS meeting #48, id.#216.05
6. Brueshaber, S.R., and Sayanagi, K.M. 2016, Dynamics of Giant Planet Polar Vortices, American Astronomical Society, DPS meeting #48, id.#501.01
7. Blalock, J.J., Sayanagi, K.M., Ingersoll, A.P., Dyudina, U.A., Ewald, S.P., Measurements of Seasonal Changes in Saturn's Zonal Wind and Vertical Wind Shear between 2004 and 2016 from Cassini ISS Images, American Astronomical Society, DPS meeting #48, id.#514.09
8. Sayanagi, K.M., Dillman, R., Spilker, T., Darrach, M. and NASA Langley Research Center Engineering Design Studio., Two-stage 20-bar giant planet atmospheric entry probe design, Outer Planets Assessment Group Meeting, August 2016.

### Conference Presentations (2015):

1. Sayanagi, K.M. and 11 Co-Authors, HST and ground-based observations of bright storms on Uranus during 2014-2015, AGU Fall Meeting P41B-2055
2. Blalock, J.J., Sayanagi, K.M., Method for Calculating Uncertainty In Automated Cloud-tracking Wind Measurements, AGU Fall Meeting P41B-2061
3. Sayanagi, K. M., and 6 Co-Authors, Effect of the 77 degree N Jet on Saturn's Hexagon Cloud Morphology, American Astronomical Society, DPS meeting #47, id.#311.18
4. Rathbun, J.A., Dones, L., Gay, P., Cohen, B., Horst, S., Lakdawalla, E., Spickard, J., Milazzo, M., Sayanagi, K.M., Schug, J. Historical trends of participation of women in robotic spacecraft missions, American Astronomical Society, DPS meeting #47, id.#312.01
5. Hueso, R. and 23 Co-Authors, Bright features in Neptune on 2013-2015 from ground-based observations with small (40 cm) and large telescopes (10 m), American Astronomical Society, DPS meeting #47, id.#400.02
6. Blalock, J.J., Sayanagi, K.M., Ingersoll, A.P., Ewald, S.P., Dyudina, U.A., Updated Measurements of Saturn's Zonal Wind between 2004 - 2014 from Cassini ISS Images, American Astronomical Society, DPS meeting #47, id.#311.08.
7. De Pater and 8 Co-Authors, Extreme Storm Activity on Uranus 7 Years After Equinox, Asiana-Oceania Geosciences Society Annual Meeting, PS08-06-D4-PM2-324-016.
8. Sayanagi, K. M., and 4 Co-Authors, Cassini Imaging Science at Saturn: Global Atmospheric Dynamics and Cloud Morphology, Japan Geoscience Union Meeting PPS01-05
9. Wong, M. H., Simon, A. A., Orton, G. S., de Pater, I., Sayanagi, K. M., Hubble's Long-Term Program Observes Cloud Activity on Uranus, 46th LPSC, LPI Contribution No. 1832, p.2606

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### Conference Presentations (2014):

1. Sayanagi, K. M., Ingersoll, A. P., Ewald, S. P., Dyudina, U. A., Blalock, J.J., Morales-Juberias, R., Cosentino, R., Simon, A., Cassini ISS Update on Seasonally Evolving Northern Hemisphere, and a new Hexagon Model, AGU Fall Meeting, P21E-05.
2. Sayanagi, K. M., Dyudina, U. A., Ewald, S. P., Ingersoll, A. P., Analysis of Saturn's Polar Vortices with Cassini ISS Images, American Astronomical Society, DPS meeting #46, id.#508.03
3. Morales-Juberias, R., Sayanagi, K.M., Cosentino, R.E., Simon, A.A., Numerical Modeling of Saturn's Northern Hexagon as a Meandering Shallow Jet, American Astronomical Society, DPS meeting #46, id.#422.22
4. Brueshaber, S. R. and Sayanagi, K. M. Numerical Simulations of Saturn's Polar Cyclones. Bulletin of American Astronomical Society #46, #422.27
5. Blalock, J.J., Sayanagi, K.M., Dyudina, U.A., Ewald, S.P., Ingersoll, A.P., Saturn's Zonal Winds at Cloud Level between 2004-2013 from Cassini ISS Images, American Astronomical Society, DPS meeting #46, id.#511.07
6. Sayanagi, K. M., Ingersoll, A. P., Ewald, S. P., Dyudina, U. A., Blalock, J.J., Cassini ISS Observation of Saturn's North Polar Vortex and the Hexagon, Asia Oceania Geosciences Society, Sapporo, Japan, PS08-11-D1-AM2-CC-004
7. Fischer, G., Dyudina, U.A., Sayanagi, K.M., Pagara, J.A., Lightning activity in Saturn's Great White Spot of 2010/2011, EGU General Assembly 2014, Vol. 16, EGU2014-5027
8. White, A., Barranco, J. A., Marcus, P., Solari, O., Sayanagi, K. M., Applying Advection-Corrected Correlation Image Velocimetry techniques to Saturn's winds, American Astronomical Society, AAS Meeting #223, id.#247.10

### Conference Presentations (2013):

1. Sayanagi, K. M., Ewald, S. P., Dyudina, U. A., Ingersoll, A. P., Updates on Saturn's Northern High-Latitude Cloud Morphology and the Aftermath of the 2010 Giant Storm from Cassini ISS, AGU Fall Meeting SM21C-2201
2. Morales-Juberias, R., Simon-Miller, A. A., Dowling, T.E., Sayanagi, K. M., Choi, D. S., Numerical Simulations of a Jovian Ribbon-like Feature, AGU Fall Meeting P21B-1718
3. Sayanagi, K.M. and 5 Co-Authors, 2013, Comparison of Atmospheric Dynamics Regimes on Jupiter and Saturn: Modeling and Observation, COSPAR Symposium, Bangkok, Thailand, Vol. 1, p.15
4. Sayanagi, K.M., Ewald, S. P., Dyudina, U. A., Ingersoll, A. P., Cassini ISS Analysis of Saturn's Northern High-Latitudes and the Aftermath of the 2010 Great Storm", Bulletin of American Astronomical Society #45, #509.06
5. Heavens, N. and Sayanagi, K.M., "Modeling the Transition From Jets to Polar Turbulence in Giant Planet Atmospheres", Bulletin of American Astronomical Society #45, #509.02
6. Blalock, J. J., Draham, R. L., Holmes, J. A., Sayanagi, K. M., "Zonal Wind Speeds, Vortex Characteristics, and Wave Dynamics in Saturn's Northern Hemisphere", Bulletin of American Astronomical Society #45, #312.10
7. Fischer and 7 Co-Authors, Saturn's magnetospheric rotation after equinox and a possible influence by the Great White Spot, European Planetary Science Congress, Vol. 8, EPSC2013-1011
8. Delcroix, M. and 5 Co-Authors, Saturn northern hemisphere's atmosphere and polar hexagon in 2013, European Planetary Science Congress, Vol. 8, EPSC2013-1067-3
9. Simon-Miller, A. A., Morales-Juberias, R., Sayanagi, K. M., Read, P. L., Choi, D. S., "A New Feature on Jupiter: Comparison with Saturn's Ribbon", LPI Contribution No. 1719, p.1110

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### Conference Presentations (2012):

1. Sayanagi, K.M. and 23 Co-Authors, Developing a Standardized Testing Procedure for Cloud Tracking Wind Measurement Methods, AGU Fall Meeting PI3C-1971
2. Fischer, G., and 9 Co-Authors, The influence of the Great White Spot on the rotation of Saturn's magnetosphere (Invited), AGU Fall Meeting SM42C-013
3. Fischer, G., Sayanagi, K.M. and 7 Co-Authors, Thunderstorm and lightning observations during and after the Great White Spot event on Saturn, AGU Fall Meeting AE23A-01313
4. Sayanagi, K.M., Mitchell, J.L., and Heavens, N.G., "Polar Atmospheric Dynamics of Jupiter," American Astronomical Society, DPS meeting #44, id.#412.05

### External Research Funding:

**Career Total Awarded as PI or Institutional PI: \$2,057,347**

**Career Total Awarded: \$6,804,234**

Principal Investigator, 2019-2022: \$388,942 funded by NASA Cassini Data Analysis Program

Proposal Title: Temporal Evolution of the Aftermath of Saturn's 2010-2011 Great Storm through multi-spectral analysis of Cassini ISS and VIMS images

Principal Investigator, \$35,456 funded by JPL-MSI Research Program

Proposal Title: Technologies & Concepts for Small Probe Exploration of Ice Giant Atmospheres

Principal Investigator, 2018-2019: \$25,460 funded by NSF EAGER supplement program

Proposal Title: EAGER: Undergraduate Astronomy Research and Education through Observation of Jupiter Impact Flashes to Characterize Small-Body Populations in the Outer Solar System

Principal Investigator, 2018-2019, \$15,000 funded by NASA Cassini Project through Caltech

Proposal Title: NASA Cassini Subaward from Caltech

Principal Investigator, 2018-2019: \$39,596 funded by NASA Langley Research Center through SSAI

Proposal Title: Supporting LaRC Planetary Science Research

Principal Investigator, 2017-2018, \$15,000 funded by NASA Cassini Project through Caltech

Proposal Title: NASA Cassini Subaward from Caltech

Principal Investigator, 2017-2018: \$434,716 funded by NASA PSDS3 Program.

Proposal Title: *SNAP: Small Next-generation Atmospheric Probe*

Principal Investigator, 2016-2018: \$259,157 funded by NSF EAGER Program.

Proposal Title: *Undergraduate Astronomy Research and Education through Observation of Jupiter Impact Flashes to Characterize Small-Body Populations in the Outer Solar System*

Principal Investigator / Faculty Advisor, 2016-2018: \$11,000 funded by Virginia Space Grant Graduate Fellowship Program. (Fellowship Applicant: Ryan McCabe, Hampton University)

Proposal Title: *Space- and Ground-based Observation of Venusian Equatorial Waves*

Principal Investigator, 2015-2016: \$38,500 research contract funded by NASA Langley Research Center

Proposal Title: *LaRC Planetary Science Capture Plan Implementation Strategy*

Principal Investigator / Faculty Advisor, 2015-2018: \$97,000 from NASA Earth and Planetary Science Fellowship Program. (Fellowship Applicant: John Blalock, Hampton University)

Proposal Title: *Measurement of Seasonal Changes in Saturn's Zonal Wind Profile*

Co-Investigator, 2015-2020: \$3,747,037 funded by NASA Nexus for Exoplanet System Science Program (PI: William Moore, Hampton University)

Proposal Title: *Living, Breathing Planet*

Co-Investigator, 2015-2018: \$109,762 Subcontract from GSFC, NASA Cassini Data Analysis Program

(PI: Amy Simon, NASA Goddard Space Flight Center)

Proposal Title: *Investigations of Saturn's Wind Field, Turbulence, and Vortices*



## Kunio M. Sayanagi

### External Research Funding (Continued):

Principal Investigator, 2014-2015: \$25,919 funded by Hubble Space Telescope Cycle 22

Proposal Title: *Target of Opportunity Observation of an Episodic Storm on Uranus*

Principal Investigator, 2014-2017: \$145,000 funded by NASA Planetary Atmospheres Program

Proposal Title: *Resolving Outstanding Atmospheric Dynamics Questions on Jupiter and Saturn through Standardized Benchmarking of Planetary Cloud-Tracking Wind Measurements*

Principal Investigator / Faculty Advisor, 2014-2016: \$11,000 from Virginia Space Grant Graduate Fellowship Program. (Fellowship Applicant: John Blalock, Hampton University)

Proposal Title: *Seasonal Variability in Saturn's Vertical Wind Shear: Cloud Tracking Wind Measurements Using Cassini ISS Images*

Co-Investigator, 2013: \$999,950 funded by NSF HCBU-RISE Program

(PI: William Moore, Hampton University)

Proposal Title: *HCBU-RISE Hampton University: Advanced Physical Modeling and Simulation for 21st Century Scientists*

Principal Investigator, 2013-2014: \$10,000 funded by Virginia Space Grant Consortium New Investigators Program (Plus \$10,000 cost-share agreement by Hampton University)

Proposal Title: *Cassini Imaging Science Investigation of Saturn's Cloud Dynamics*

Principal Investigator, 2012-2015: \$141,079 funded by NSF Astronomy and Astrophysics Program

Proposal Title: *Resolving Outstanding Atmospheric Dynamics Questions on Jupiter and Saturn through Standardized Benchmarking of Planetary Cloud-Tracking Wind Measurements*

Postdoctoral Affiliate, 2012-2014: \$363,913 funded by NASA Planetary Atmospheres Program

(PI: Jonathan Mitchell, UCLA)

Proposal Title: *Understanding Titan's climate, weather, and winds using a Planetary Climate-modeling Hierarchy*

Principal Investigator, 2011-2015: \$252,782 funded by NASA Outer Planets Research Program

Proposal Title: *Understanding JUNO's Two Frontiers: Atmospheric Dynamics at Jupiter's Poles and the Water Cloud Base; and Lessons from Cassini at Saturn*

# Kunio M. Sayanagi

## Professional Appointments:

Associate Professor, Hampton University

August 2017-now: - Develop and teach graduate-level atmospheric and planetary science curriculum; supervise and train graduate students. Raise research funding.

Visiting Scientist, California Institute of Technology

August 2017-now: - Analyze and archive images captured during the final year of the Cassini Mission in collaboration with Dr. A. P. Ingersoll

Visiting Researcher, University of California, Berkeley

Summer 2013: - Develop cloud-tracking wind measurement method and apply it to Saturn in collaboration with Dr. P. S. Marcus

Assistant Professor, Hampton University

2012-2017: - Develop and teach graduate-level atmospheric and planetary science curriculum; supervise and train graduate students. Raise research funding.

Visiting Scientist, California Institute of Technology

June - Dec 2011: - Analyze a new giant storm on Saturn using images acquired by Cassini ISS camera in collaboration with Dr. A. P. Ingersoll

Postdoctoral Scholar, University of California Los Angeles

2010 - 2011: - Atmospheric Simulations of Jupiter, Saturn, Titan, and Extrasolar Planets  
- Developing validation method for planetary wind measurements in collaboration with Dr. J. L. Mitchell

Postdoctoral Scholar, California Institute of Technology

2008 - 2010: - Analyze Jetstreams behaviors on Jupiter and Saturn through Modeling and Cassini Observations in collaboration with Dr. A. P. Ingersoll

Postdoctoral Research Fellow, University of Louisville

2007 - 2008: - Stability of Jovian Zonal Jets and super-rotation of Venus/Titan in collaboration with Dr. T. E. Dowling

Post-Graduate Research, University of Arizona

2003 - 2007: - Dissertation Topic: Atmospheric dynamics of the Jovian Planets  
Adviser: Dr. A. P. Showman

2002 - 2003: - Developed Jupiter's deep convection numerical model in collaboration with Dr. A. J. Friedson (Jet Propulsion Lab).  
Adviser: Dr. A. P. Showman

2001 - 2002: - Developed a data interface for EGOPS Radio Occultation package to perform simulated occultations on observed atmospheric profiles  
Adviser: Dr. E. R. Kursinski

NSF Research Experience for Undergraduates Program Fellow, Baylor University

Summer 1999: - Developed a planetary system formation numerical model.  
Adviser: Dr. T. W. Hyde

## **Kunio M. Sayanagi**

### **Space Mission Participation:**

- PI, SNAP: Small Next-generation Atmospheric Probe Concept Study funded by NASA PSDS3 Program  
2017-2018: - Mission concept study for of an atmospheric probe for Uranus
- Co-I, Hera Saturn Probe Proposal for ESA's M-class Mission Program  
2016: - Provide atmospheric dynamics expertise  
Proposal PI: Dr. Olivier Mousis (Institut Universitaire de France)
- PI, Two-Stage Saturn Probe Concept Study, funded by NASA Langley Research Center  
2016: - Mission concept study to probe below Saturn's water cloud layer
- PI, Hubble Space Telescope Target of Opportunity Observation of Uranus  
2014: - Observe Episodic Storm on Uranus; Observation Triggered October 2014  
Proposal submitted in partnership with NASA Langley Research Center
- Co-I, Jupiter Icy Moon Imager Proposal for ESA's JUICE Mission  
2012: - Take Lead on Jupiter Atmospheric Science Investigation Topics on the Proposal  
Proposal PI: Dr. Elizabeth Turtle (JHU/APL)
- Study Lead, Trojan Asteroid Tour and Rendezvous Mission JPL/Team-X Mission Design Exercise  
2011: - Lead the JPL Planetary Science Summer School mission design exercise  
Team-X Mentor: Dr. Charles Budney (JPL)
- Co-I, Outer Solar System Mission proposal to ESA's Middle-class Mission Program  
2010: - Coauthor Neptune Atmospheric Science section of the proposal  
Proposal P.I.: Dr. Bruno Christophe (Onera: French Aerospace Lab)
- Co-I, Uranus Pathfinder proposal to ESA's Middle-class Mission Program  
2010: - Coauthor Uranus Atmospheric Science Section of the proposal  
Proposal P.I.: Dr. Christopher Arridge (University College London)
- Co-I, AVIATR: Aerial Vehicle for In-situ and Airborne Titan Reconnaissance  
2010: - Develop Atmospheric Dynamics portion of the science proposal  
to NASA's Discovery-class Mission Program  
Proposal P.I.: Dr. Jason W. Barnes (University of Idaho)
- Invited Participant, Europa-Jupiter System Mission Science Definition Team  
2010-2011: - Help Define Science Goals of NASA's next Outer Planet Flagship Mission  
Project Scientist: Dr. Robert T. Pappalardo (Jet Propulsion Lab)
- Decadal Survey Panelist, Saturn Atmospheric Entry Probe Decadal Mission Study  
2009-2010: - Provide science input to Engineering Feasibility Study of mission to Saturn  
as part of the 2013 Planetary Decadal Survey  
Study Leads: Dr. Thomas Spilker (Jet Propulsion Lab), Reta Beebe (New Mexico State U.)
- Study Team Member, Mission Concept Development, Planetary Dynamics Explorer  
2009-present: - Develop concept for a new planetary-dedicated space telescope  
to be proposed to NASA's Discovery-class Mission program  
P.I.: Dr. Michael H. Wong (UC Berkeley)
- Affiliate Team Member, Cassini Imaging Science Subsystem (ISS)  
2008-present: - Make atmospheric dynamics measurements using ISS images of Saturn  
- Troubleshoot data processing pipeline  
Team Lead: Dr. Carolyn C. Porco (Space Science Institute)

## **Kunio M. Sayanagi**

### **Community Service and Leadership Experience:**

Served as a Peer Reviewer for:

Geophysical Research Letters  
Nature,  
Nature Astronomy,  
Nature Geoscience,  
Icarus,  
Planetary and Space Science

Served as a Session Convener at:

COSPAR Symposium (2013)  
AGU Fall Meeting (2013, 2014, 2015, 2016)  
Japan Geoscience Union (2015, 2016, 2017)

Awards Subcommittee, American Astronomical Society Division of Planetary Science (DPS)  
2017 - 2018 - Evaluation nominations for DPS awards

Permanent Member, Steering Committee, International Outer Planets Watch  
2016 - now - Oversee coordination of outer planets observation activities

Steering Committee Member, NASA Outer Planets Assessment Group  
2016 - now - Assess NASA's Outer Solar System Exploration Priorities

Member, Forum for New Leaders in Space Science  
2014 - Review and Discuss latest development in Space Science in a joint program  
between U.S. National Academy of Sciences and Chinese Academy of Sciences

Official Reviewer, Lessons Learned in Decadal Planning in Space Science, National Research Council  
2013 - Review the summary report of the NRC workshop's summary report.

Member, Federal Relations Subcommittee, Division of Planetary Sciences, American Astronomical Soc.  
2012 - 2015 - Formulate and Recommend Federal Policies supporting Planetary Sciences.

Rotating Member, Steering Committee, International Outer Planets Watch  
2012 - Coordinate Amateur and Professional Observations of Jupiter and Saturn

Vice President for Advocacy, UCLA Society of Postdoctoral Scholars  
2011 - 2012: - Organize social, career and outreach events for UCLA Postdocs

Member, Giant Planets Panel, National Academy Planetary Science Decadal Survey  
2009 - 2010: - Compile and author Planetary Science research priority recommendations  
to NASA and NSF for 2013-2023 decade

Executive Board Chair, the California Institute of Technology Postdoctoral Association  
2009-2010: - Serve as the leader of the Caltech Postdoc Association

Science Writer, Ars Technica <http://arstechnica.com/author/kunio-m-sayanagi-2/>  
2008-now: - Write commentaries about latest scientific journal articles

Chair, Physics Graduate Student Council, University of Arizona  
2005-2006: - Assisted Graduate Director and Department Head with Curriculum revisions  
- Organize Graduate Student Seminar series

# Kunio M. Sayanagi

## Teaching and Student Supervision Experience:

Associate Professor, Hampton University (since August 2018)

2017-now: - Planetary Science PhD Student, Justin Garland (PhD Expected 2023)

2017-2018: - Post Baccalaureate Researcher, Jacob Gunnarson

Assistant Professor, Hampton University

2015-now: - Planetary Science PhD Student, Ryan McCabe (PhD expected 2020)

2013-now: - Planetary Science PhD. Student, John Blalock (PhD expected 2018)

2015-now: - Graduate-level Geophysical Fluid Dynamics (APS662)

2014-now: - Graduate-level Atmospheric Dynamics (APS660)

2013-now: - Graduate-level Atmospheric Physics and Chemistry (APS704)

2012-2013: - General-Education Undergraduate Astronomy (APS105)

Virginia Governor's School High School Student Research Mentoring Program

2016-2017: - Julie Zhou (Jupiter Wind Speed Measurements)

2015-2016: - Claire Du (Cassini Orbiter Image Processing)

Summer Undergraduate Research Supervisor, Hampton University

2012, 2013: - Supervise a summer student to develop a tool to track Polar Mesospheric Clouds in images by Aeronomy of Ice in Mesosphere Mission and measure wind

Summer Undergraduate Research Supervisor, University of California Los Angeles

2011: - Supervise a summer student to develop a method to measure the shape of Saturn by analyzing the shadows of Saturn's rings cast on the planet

Summer Undergraduate Research Fellow Mentor, California Institute of Technology

2010: - Supervise a summer student to analyze images of Saturn returned from Cassini spacecraft, and develop a conference presentation authored by the student

Teaching Assistant, Physics, University of Arizona

2001: - Teach two introductory physics laboratory course sections

Teaching Assistant, Astronomy, Juniata College

1997-2000: - Run Observation sessions for introductory astronomy class  
- Grade assignments and exams

## Public Outreach Activities:

Virginia Living Museum Star Party Presenter (2014)

Back Bay Astronomy Association Guest Speaker (2014, 2015, 2016, 2017, 2018)

Art Central Phoebus Art Gallery "Art Talk Monday" Guest Presenter (2017)

Virginia Peninsula Astronomers and Stargazers, Planetarium Speaker (2012, 2013, 2014, 2015, 2016)

Science Writer, Ars Technica, <http://arstechnica.com/author/kunio-m-sayanagi-2/> (2008-)

University of Louisville Planetarium, "Mission Monday" Presenter (2008)

University of Louisville Planetarium, "Mars Phoenix Landing Event" Commentator (2008)

Kitt Peak National Observatory, Saturn Opposition Event Presenter (2007)

Flandrau Science Museum and Planetarium, Saturn Opposition Event Speaker (2007)

Math and Science Volunteer Presenter, Safford Magnet Middle School, Tucson, Arizona (2005)

# Kunio M. Sayanagi

## Invited Seminars:

Johns Hopkins Applied Physics Laboratory Seminar (2019)  
Virginia Space Grant Research Symposium Keynote Speech (2019)  
Hampton University, Atmospheric and Planetary Science Seminar (2018)  
Hampton University, Physics Colloquium (2018)  
Virginia Union University, Physics Seminar (2017)  
Japan Aerospace Exploration Agency, Institute of Space and Aeronautical Sciences Seminar (2016)  
Society of Physics Students Zone 4 Meeting Invited Speaker (2016)  
North Carolina A&T University Physics Colloquium (2016)  
College of William and Mary Physics Colloquium (2015)  
Hampton University Physics Colloquium (2015)  
Japan Aerospace Exploration Agency, Institute of Space and Aeronautical Sciences Seminar (2015)  
Christopher Newport University Physics, Engineering and Computer Science Seminar (2014)  
Florida Institute of Technology, Physics and Astronomy Seminar (2014)  
University of Central Florida, Planetary Science Seminar (2014)  
University of Florida, Physics Department Seminar (2014)  
Western Michigan University Mechanical Engineering Seminar (2014)  
Old Dominion University, Center for Coastal Physical Oceanography Seminar (2013)  
Baylor University, Department of Physics Seminar (2012)  
Georgia Institute of Technology, Earth and Atmospheric Science Seminar (2012)  
California Institute of Technology, Saturn Atmosphere Workshop, Invited Presenter (2012)  
University of California Los Angeles, Planetary Science Seminar (2011)  
Jet Propulsion Lab, Cassini Project Science Group Meeting Invited Presenter (2011)  
Hampton University, Atmospheric and Planetary Sciences Seminar (2011)  
Franklin and Marshall College, Physics Seminar (2010)  
Mount Holyoke College, Physics Seminar (2010)  
Juniata College, Physics Seminar (2010)  
University of California Los Angeles, Planetary Science Seminar (2010)  
Japan Aerospace Exploration Agency, Institute of Space and Aeronautical Sciences Seminar (2010)  
Massachusetts Institute of Technology Planetary Science Seminar (2010)  
University of California Berkeley, Planetary Atmosphere Group Seminar (2010)  
University of California Los Angeles, Earth and Space Sciences Seminar (2008)  
California Institute of Technology, Planetary Science Seminar (2007)  
University of Louisville, Physics Department Seminar (2007)  
Kyoto University, Meteorology Research Group Seminar (2006)  
University of Tokyo, Center for Climate System Research Seminar (2006)  
Hokkaido University, Division of Earth and Planetary Sciences Seminar (2006)

## Academic Honors:

2014	Member, National Academy of Sciences Forum for New Leaders in Space Science
2011	Juniata College Young Alumni Achievement Award
2009	National Academy Planetary Science Decadal Survey 2013-2022 Giant Planet Panelist
2000-present	Sigma Pi Sigma National Physics Honor Society Membership