

# Shunsaku Horiuchi

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## Research Interests

Dark matter: multi-messenger astrophysical probes of particle dark matter  
Supernovae: neutrino, cosmic ray, and gamma ray signatures

## Appointments

2020 –	Associate Professor	Virginia Tech
2022 –	Visiting Scientist	Kavli IPMU
2021 – 2022	Project Associate Professor	Kavli IPMU
2014 – 2020	Assistant Professor	Virginia Tech
2012 – 2014	JSPS Fellow & McCue Fellow	University of California, Irvine
2009 – 2012	CCAPP Postdoctoral Fellow	The Ohio State University

## Education

2005 – 2009	Ph.D., Physics	University of Tokyo
2001 – 2005	B.A., M.A., M.Sci., Natural Science	University of Cambridge

## Selected Publications

Excluding those within large ( $\gtrsim 10$  persons) collaborations.

82. Chauhan, G., **Horiuchi, S.**, Huber, P., Shoemaker, I., 2023, *Low-Energy Supernovae Bounds on Sterile Neutrinos*, submitted. arXiv:2309.05860
81. Healy, S., **Horiuchi, S.**, Colomer, M., Milisavjevic, D., Tseng, J., Bergin, F., Weil, K., Tanaka, M., 2023, *Red Supergiant Candidates for Multimessenger Monitoring of the Next Galactic Supernova*, submitted. arXiv:2307.08785
80. Ando, S., Ekanger, N., **Horiuchi, S.**, Koshi, Y., 2023, *Diffuse neutrino background from past core-collapse supernovae*, accepted. arXiv:2306.16076
79. Mori, K., Takiwaki, T., Kotake, K., **Horiuchi, S.**, 2023, *Multi-messenger signals of heavy axionlike particles in core-collapse supernovae: 2D simulations*, accepted. arXiv:2304.11360
78. Ekanger, N., Bhattacharya, M., **Horiuchi, S.**, 2023, *Nucleosynthesis in outflows of compact objects and detection prospects of associated kilonovae*, Mon.Not.Roy.Astron.Soc. **525** (2023) 2040
77. Heston, S., Kehoe, E., Yudai, S., **Horiuchi, S.**, 2023, *Timing coincidence search for supernova neutrinos with optical transient surveys*, Phys.Rev.D **107** (2023) 12, 123034

76. Cowie, F., Offringa, A., Gehlot, B., Singal, J., Heston, S., **Horiuchi, S.**, Lucero, D., 2023, *Diffuse Sources, Clustering and the Excess Anisotropy of the Radio Synchrotron Background*, Mon.Not.Roy.Astron.Soc. **523** (2023) 4, 5034-5046
75. Bhattacharya, M., Carpio, J., Murase, K., **Horiuchi, S.**, 2023, *High-energy neutrino emission from magnetised jets of rapidly rotating protomagnetars*, Mon.Not.Roy.Astron.Soc. **521** 2391
74. Mori, K., Moriya, T., Takiwaki, T., Kotake, K., **Horiuchi, S.**, Blinnikov, S., 2023, *Light Curves and Event Rates of Axion Instability Supernovae*, Astrophys.J. **943** 1, 12
73. Roach, B., Rosslund, S., Ng, K., Perez, K., Beacom, J., Grefenstette, B., **Horiuchi, S.**, Krivonos, R., Wik, D., 2023, *Long-exposure NuSTAR constraints on decaying dark matter in the Galactic halo*, Phys.Rev.D **107** 2, 023009
72. Ekanger, E., **Horiuchi, S.**, Kotake, K., Sumiyoshi, K., 2022, *Impact of late-time neutrino emission on the Diffuse Supernova Neutrino Background*, Phys.Rev.D **106** 4, 043026
71. Ziegler, J., Edwards, T., Suliga, A., Tamborra, I., **Horiuchi, S.**, Ando, S., Freese, K., 2022, *Non-Universal Stellar Initial Mass Functions: Large Uncertainties in Star Formation Rates at  $z \approx 2-4$  and Other Astrophysical Probes*, Mon.Not.Roy.Astron.Soc. **517**, 2471
70. Crocker, R., Macias, O., Mackey, D., Krumholz, M., Ando, S., **Horiuchi, S.**, Baring, M., Gordon, C., Venville, T., Duffy, A., Yang, R., Aharonian, F., Hinton, J., Song, D., Ruiter, A., Filipovic, M., 2022, *Gamma-ray emission from the Sagittarius dwarf spheroidal galaxy due to millisecond pulsars*, Nature Astron. **6**, 1317
69. Zimmer, F., Macias, O., Ando, S., Crocker, R., **Horiuchi, S.**, 2022, *The Andromeda Gamma-Ray Excess: Background Systematics of the Millisecond Pulsars and Dark Matter Interpretations*, Mon.Not.Roy.Astron.Soc. **516**, 4469
68. Baum, S., Capozzi, F., **Horiuchi, S.**, 2022, *Rocks, Water and Noble Liquids: Unfolding the Flavor Contents of Supernova Neutrinos*, Phys.Rev.D **106** 12, 123008
67. Ekanger, E., Bhattacharya, M., **Horiuchi, S.**, 2022, *Systematic exploration of heavy element nucleosynthesis in protomagnetar outflows*, Mon.Not.Roy.Astron.Soc. **513**, 405
66. Mori, K., Takiwaki, T., Kotake, K., **Horiuchi, S.**, 2022, *Shock revival in core-collapse supernovae assisted by heavy axionlike particles*, Phys.Rev.D **105** 6, 063009
65. Bhattacharya, M., **Horiuchi, S.**, Murase, K., 2022, *On the synthesis of heavy nuclei in protomagnetar outflows and implications for ultra-high energy cosmic rays*, Mon.Not.Roy.Astron.Soc. **514**, 6011
64. Offringa, A., Singal, J., Heston, S., **Horiuchi, S.**, Lucero, D., 2021, *Measurement of the anisotropy power spectrum of the radio synchrotron background*, Mon.Not.Roy.Astron.Soc. **509**, 114
63. Siebert, T., Crocker, R. M., Macias, O., Panther, F. H., Calore, F., **Horiuchi, S.**, Song, D., and Tomsick, J. A., 2021, *Galactic positrons from old stars in the bulge: measurement of propagation length*, Mon.Not.Roy.Astron.Soc.Lett. **509**, L11
62. Macias, O., van Leijen, H., Song, D., Ando, S., **Horiuchi, S.**, 2021, *Cherenkov Telescope Array sensitivity to the putative millisecond pulsar population responsible for the Galactic center excess*, Mon.Not.Roy.Astron.Soc. **506** 1741
61. Tapia-Arellano, N. & **Horiuchi, S.**, 2021, *Measuring solar neutrinos over gigayear timescales with paleo detectors*, Phys.Rev.D **103** 12, 123016
60. Song, D., Macias, O., **Horiuchi, S.**, Crocker, R., Nataf, D., 2021, *Evidence for inverse*

- Compton emission from globular clusters*, Mon.Not.Roy.Astron.Soc. **507**, 5161
59. **Horiuchi, S.**, Kinugawa, T., Takiwaki, T., Kotake, K., 2021, *Binary interactions enhance the Diffuse Supernova Neutrino Background*, Phys.Rev.D **103** 4, 043003
  58. Tabrizi, Z. & **Horiuchi, S.**, 2021, *Flavor Triangle of the Diffuse Supernova Neutrino Background*, JCAP **05**, 011
  57. Zaizen, M., **Horiuchi, S.**, Takiwaki, T., Kotake, K., Yoshida, Y., Umeda, H., Cherry, J. F., 2021, *Three-flavor collective neutrino conversions with multi-azimuthal-angle instability in an electron-capture supernova model*, Phys.Rev.D **103** 6, 063008
  56. Nataf, D. M., **Horiuchi, S.**, Costa, G., Wyse, R. F. G., Ting, Y-S, Crocker, R., Federrath, C., 2020, *The Predicted Properties of Helium-Enriched Globular Cluster Progenitors at High Redshift*, Mon.Not.Roy.Astron.Soc. **496**, 3222
  55. Abazajian, K. N., **Horiuchi, S.**, Kaplinghat, M., Keeley, R. E., Macias, O., 2020, *Strong constraints on thermal relic dark matter from Fermi-LAT observations of the Galactic Center*, Phys.Rev.D **102** 4, 043012
  54. Cherry, J. F., Fuller, G. M., **Horiuchi, S.**, Kotake, K., Takiwaki, T., Fischer, T., 2020, *Time of Flight and Supernova Progenitor Effects on the Neutrino Halo*, Phys.Rev.D **102** 2, 023022
  53. Shirasaki, M., Macias, O., Ando, S., **Horiuchi, S.**, Yoshida, Y., 2020, *Cross Correlation of the Extragalactic Gamma-ray Background with Thermal Sunyaev-Zel'dovich Effect in the Cosmic Microwave Background*, Phys.Rev.D **101** 10, 103022
  52. Zaizen, M., Cherry, J. F., Takiwaki, T., **Horiuchi, S.**, Kotake, K., Umeda, H., Yoshida, Y., 2020, *Neutrino halo effect on collective neutrino oscillation in iron core-collapse supernova model of a 9.6 solar mass star*, JCAP **06**, 0411
  51. Roach, B. M., Ng, K. C. Y., Perez, K., Beacom, J. F., **Horiuchi, S.**, Krivonos, R., Wik, D. R., 2020, *NuSTAR Tests of Sterile-Neutrino Dark Matter: New Galactic Bulge Observations and Combined Impact*, Phys.Rev.D **101** 10, 103011
  50. Sasaki, H., Takiwaki, T., Kawagoe, S., **Horiuchi, S.**, Ishidoshiro, K., 2020, *Detectability of Collective Neutrino Oscillation Signatures in the Supernova Explosion of a 8.8  $M_{\odot}$  star*, Phys.Rev.D. **101** 6, 063027
  49. Song, D., Macias, O., **Horiuchi, S.**, 2019, *Inverse-Compton emission from Millisecond Pulsars in the Galactic bulge*, Phys.Rev.D **99** 123020
  48. Macias, O., **Horiuchi, S.**, Kaplinghat, M., Gordon, C., Crocker, R. M., Nataf, D. M., 2019, *Strong Evidence that the Galactic Bulge is Shining in Gamma Rays*, JCAP **09**, 042
  47. Ng, K. C. Y., Roach, B. M., Perez, K., Beacom, J. F., **Horiuchi, S.**, Krivonos, R., Wik, D. R., 2019, *New Constraints on Sterile Neutrino Dark Matter from NuSTAR M31 Observations*, Phys.Rev.D **99** 083005.
  46. Ammazzalorso, S., Fornengo, N., **Horiuchi, S.**, Regis, M., 2018, *Characterizing the local gamma-ray Universe via angular cross-correlations*, Phys.Rev.D **98** no.10, 103007
  45. Hashimoto, D., Nishizawa, A. J., Shirasaki, M., Macias, O., **Horiuchi, S.**, Tashiro, H., Oguri, M., 2018, *Measurement of redshift dependent cross correlation of HSC clusters and Fermi gamma rays*, Mon.Not.Roy.Astron.Soc. **484**, 5256
  44. Shirasaki, M., Macias, O., **Horiuchi, S.**, Yoshida, Y., Lee, C. H., Nishizawa, A., 2018, *The correlation of extragalactic gamma-rays with cosmic matter density distributions from weak-gravitational lensing*, Phys.Rev.D **97** no.12, 123015

43. Zhang, B. T., Murase, K., Kimura, S. S., **Horiuchi, S.**, Meszaros, P., 2018, *Low-luminosity gamma-ray bursts as the sources of ultrahigh-energy cosmic ray nuclei*, Phys.Rev.D **97** no.8, 083010
42. Wang, W-Y, Cherry, J. F., **Horiuchi, S.**, Strigari, L. E., 2017, *Bounds on Resonantly-Produced Sterile Neutrinos from Phase Space Densities of Milky Way Dwarf Galaxies*, arXiv:1712.04597, submitted to Phys.Rev.D
41. **Horiuchi, S.**, Sumiyoshi, K., Nakamura, K., Fischer, T., Summa, A., Takiwaki, T., Janka, H. T., Kotake, K., 2018, *Diffuse Supernova Neutrino Background from extensive core-collapse simulations of 88-100M<sub>⊙</sub>-100M<sub>⊙</sub> progenitors*, Mon.Not.Roy.Astron.Soc. **475**, 1363
40. Nikrant, A., Laha, R., **Horiuchi, S.**, 2018, *Robust measurement of supernova  $\nu_e$  spectra with future neutrino detectors*, Phys.Rev.D **97**, 023019
39. Canac, N. E., Abazajian, K. N., Tajima, T., Ebisuzaki, T., **Horiuchi, S.**, 2020, *Observational Signatures of Gamma Rays from Bright Blazars and Wakefield Theory*, Mon.Not.Roy.Astron. Soc. **493**, 2229
38. **Horiuchi, S.**, Kneller, J., 2018, *What can be learned from a future supernova neutrino detection?*, J.Phys.G **45** no. 4, 043002 [Invited review article]
37. **Horiuchi, S.**, Nakamura, K., Takiwaki, T., Kotake, K., 2017, *Estimating the core compactness of massive stars with Galactic supernova neutrinos*, J.Phys.D **44** no.11, 114001
36. Cherry, J. F., **Horiuchi, S.**, 2017, *Closing in on Resonantly Produced Sterile Neutrino Dark Matter*, Phys.Rev.D **95**, 083015
35. Macias, O., Gordon, C., Crocker, R., Coleman, B., Paterson, D., **Horiuchi, S.**, Pohl, M., 2018, *Discovery of Gamma-Ray Emission from the X-shaped Bulge of the Milky Way*, Nature Astron. no. 5, 387-392
34. Perez, K., Ng, K., Beacom, J., Hersh, C., **Horiuchi, S.**, Krivonos, R., 2017, *(Almost) Closing the Sterile Neutrino Dark matter Window with NuSTAR*, Phys.Rev.D **95**, 123002
33. Ankowski, A., Beacom, J., Benhar, O., Chen, S., Cherry, J., Cui, Y., Friedland, A., Botella, I., Haghghat, A., **Horiuchi, S.** (corresponding author), Huber, P., Kneller, J., Laha, R., Li, S., Link, J., Lovato, A., Macias, O., Mariani, C., Mezzacappa, A., O'Connor, E., O'Sullivan, E., Rubbia, A., Scholberg, K., Takeuchi, T., 2016, *Supernova Physics at DUNE*, arXiv:1608.07853
32. Shirasaki, M., Macias, O., **Horiuchi, S.**, Shirai, S., Yoshida, Y., 2016, *Cosmological constraints on dark matter annihilation and decay: Cross-correlation analysis of the extragalactic gamma-ray background and cosmic shear*, Phys.Rev.D **94**, 063522
31. **Horiuchi, S.**, Kaplinghat, M., Kwa, A., 2016, *Investigating the Uniformity of the Excess Gamma rays towards the Galactic Center Region*, JCAP **11**, 053
30. **Horiuchi, S.**, Macias, O., Restrepo, D., Rivera, A., Zapata, O., Silverwood, H., 2016, *The Fermi-LAT gamma-ray excess at the Galactic Center in the singlet-doublet fermion dark matter model*, JCAP **03**, 048
29. Nakamura, K., **Horiuchi, S.**, Tanaka, M. *et al.*, 2016, *Multi-messenger signals of long-term core-collapse supernova simulations: synergetic observation strategies*, Mon.Not.Roy.Astron. Soc. **461**, 3296
28. Bozek, B., Boylan-Kolchin, M., **Horiuchi, S.** *et al.*, 2016, *Resonant Sterile Neutrino Dark Matter in the Local and High-z Universe*, Mon.Not.Roy.Astron.Soc. **459**, 1489
27. **Horiuchi, S.**, Bozek, B., Abazajian, K. N. *et al.*, 2016, *Properties of Resonantly Produced*

- Sterile Neutrino Dark Matter Subhalos*, Mon.Not.Roy.Astron.Soc. **456**, 4346
26. Shirasaki, M., **Horiuchi, S.**, Yoshida, Y., 2015, *Cross-Correlation of the Extragalactic Gamma-ray Background with Luminous Red Galaxies*, Phys.Rev.D **92**, 123540
  25. Ng, K. C. Y., **Horiuchi, S.**, Gaskins, J., Smith, M., Preece, R., 2015, *Improved Limits on Sterile Neutrino Dark Matter using Full-Sky Fermi-GBM Data*, Phys.Rev.D **92**, 043503 [Selected Editors' Suggestion]
  24. Abazajian, K. N., Canac, N., **Horiuchi, S.** *et al.*, 2015, *Discovery of a New Galactic Center Excess Consistent with Upscattered Starlight*, JCAP **07**, 013
  23. **Horiuchi, S.**, Nakamura, K., Takiwaki, T. *et al.*, 2014, *The red supergiant and supernova rate problems: implications for core-collapse physics*, Mon.Not.Roy.Astron.Soc.Lett. **445**, L99
  22. Bell, N. F., **Horiuchi, S.**, Shoemaker, I. M., 2015, *Annihilating Asymmetric Dark Matter*, Phys.Rev.D **91**, 023505
  21. Garrison-Kimmel, S., **Horiuchi, S.**, Abazajian, K. N. *et al.*, 2014, *Running with BICEP2: Implications for Small-Scale Problems in CDM*, Mon.Not.Roy.Astron.Soc. **444**, 961
  20. Shirasaki, M., **Horiuchi, S.**, Yoshida, Y., 2014, *Cross-Correlation of Cosmic Shear and Extragalactic Gamma-ray Background: Constraints on the Dark Matter Annihilation Cross-Section*, Phys.Rev.D **90**, 063502
  19. Abazajian, K. N., Canac, N., **Horiuchi, S.** *et al.*, 2014, *Astrophysical and Dark Matter Interpretations of the Extended Gamma-Ray Emission from the Galactic Center*, Phys.Rev.D **90**, 023526
  18. **Horiuchi, S.**, Humphrey, P. J., Onorbe, J. *et al.*, 2014, *Sterile neutrino dark matter bounds from galaxies of the Local Group*, Phys.Rev.D **89**, 025017
  17. Lacki, B., **Horiuchi, S.**, Beacom, J. F., 2014, *The Star-Forming Galaxy Contribution to the Cosmic MeV and GeV Gamma-Ray Background*, Astrophys.J. **786**, 40
  16. Ng, K. C. Y., Laha, R., Campbell, S., **Horiuchi, S.** *et al.*, 2014, *Resolving Small-Scale Dark Matter Structures Using Multi-Source Indirect Detection*, Phys.Rev.D **89**, 083001
  15. Laha, R., Beacom, J. F., Dasgupta, B., **Horiuchi, S.** *et al.*, 2013, *Demystifying the PeV Cascades in IceCube: Less (Energy) is More (Events)* Phys.Rev.D **88**, 043009
  14. **Horiuchi, S.**, Beacom, J. F., Bothwell, M., Thompson, T. A., 2013, *Effects of stellar rotation on star formation rates and comparison to CCSN rates*, Astrophys.J. **769**, 113
  13. Kashiyama, K., Murase, K., **Horiuchi, S.** *et al.*, 2013, *High energy neutrino and gamma ray transients from relativistic supernova shock breakout*, Astrophys.J.Lett. **769**, L6
  12. Laha, R., Ng, K. C. Y., Dasgupta, B., **Horiuchi, S.**, 2013, *Galactic Center Radio Constraints on Gamma-Ray Lines from Dark Matter Annihilation*, Phys.Rev.D **87**, 043516
  11. **Horiuchi, S.**, Murase, K., Ioka, K., Meszaros, P., 2012, *The survival of nuclei in jets associated with core-collapse supernovae*, Astrophys.J. **753**, 69
  10. **Horiuchi, S.**, Beacom, J. F., Kochanek, C. S. *et al.*, 2011, *The cosmic core-collapse supernova rate does not match the massive-star formation rate*, Astrophys.J. **738**, 154
  9. Metzger, B. D., Giannios, D., **Horiuchi, S.**, 2011, *Heavy nuclei synthesized in Gamma-Ray Bursts outflows as the source of UHECRs*, Mon.Not.Roy.Astron.Soc. **415**, 2495
  8. Takami, H., **Horiuchi, S.**, 2011, *The Production of Ultra High Energy Cosmic Rays during the Early Epochs of Radio-loud AGN*, Astropart.Phys. **34**, 749

7. **Horiuchi, S.** & Beacom, J. F., 2010, *Revealing Type Ia supernova physics with cosmic rates and nuclear gamma rays*, *Astrophys.J.* **723**, 329-341
6. Dasgupta, B., Fischer, T., **Horiuchi, S.**, *et al.*, 2010, *Detecting the QCD phase transition in the next Galactic supernova neutrino burst*, *Phys.Rev.D* **81**, 103005
5. **Horiuchi, S.**, Beacom, J. F., Dwek, E., 2009, *The Diffuse Supernova Neutrino Background is detectable in Super-Kamiokande*, *Phys.Rev.D* **79**, 083013
4. **Horiuchi, S.**, Suwa, Y., Takami, H., *et. al.*, 2008, *Nonthermal neutrinos from supernovae leaving a magnetar*, *Mon.Not.Roy.Astron.Soc.* **391**, 1893
3. **Horiuchi, S.** & Ando, S., 2008, *High-energy neutrinos from reverse shocks in choked and successful relativistic jets*, *Phys.Rev.D* **77**, 063007
2. Yuksel, H., **Horiuchi, S.**, Beacom, J. F., *et. al.*, 2007, *Neutrino Constraints on the Dark Matter Total Annihilation Cross Section*, *Phys.Rev.D* **76**, 123506
1. **Horiuchi, S.** & Ando, S., 2006, *Dark matter annihilation from intermediate-mass black holes: Contribution to the extragalactic gamma-ray background*, *Phys.Rev.D* **74**, 103504

### Selected Conference Talks

61. 06/2023 Invited Talk, *PPC 2023*, IBS, South Korea
60. 05/2023 Invited Talk, *International Conference on Supernova Neutrino Detection*, LNGS, Italy
59. 12/2022 Invited Lecture, *Kobayashi-Maskawa Institute for the Origin of Particles and the Universe Winter School*, online
58. 09/2022 Invited Talk, *NNN 2022*, Hida, Japan
57. 09/2022 Invited Talk, *The 2nd DM-Net International Symposium*, Heidelberg, Germany
56. 08/2022 Invited Talk, *Supernova Brainstorm Workshop 2022*, Wroclaw, Poland
55. 05/2022 Invited Talk, *Snowmass Neutrino Colloquium*, online
54. 04/2022 Plenary, *Symposium on Gravitational wave physics and astronomy: Genesis*, YITP, Japan
53. 03/2022 Invited Talk, *Neutrinos as a Portal to New Physics and Astrophysics*, KITP
52. 09/2021 Invited Talk, *The Physical Society of Japan Autumn Meeting 2021*, online
51. 08/2021 Invited Talk, *Multimessenger Study of Heavy Dark Matter*, online
50. 06/2021 Invited Talk, *Materia Oscura en Colombia Workshop*, online
48. 05/2021 Invited Talk, *SNEWS 2021 Collaboration Meeting*, online
47. 12/2020 Invited Talk, *Snowmass: workshop on supernova and early universe neutrinos*, online
46. 01/2020 Invited Talk, *Recontres du Vietnam: Theory meeting experiments*, Vietnam
45. 12/2019 Plenary, *TeV Particle Astrophysics 2019*, Sydney
44. 10/2019 Plenary, *New Horizons in Galactic Center Astronomy and Beyond*, Tokyo
43. 07/2019 Invited Talk, *Lepton-Nucleon Scattering*, Elba, Italy
42. 05/2019 Invited debate panelist, *Fifty One Ergs 2019*, North Carolina State University
41. 03/2019 Plenary, *32rd Neutrino Workshop*, ICRR, Tokyo
40. 10/2018 Plenary, *8th Fermi Symposium*, Baltimore
39. 10/2018 Plenary, *Joint IPMU-KEK-IPPP-Duham-KIAS workshop: Beyond the BSM*, Japan
38. 10/2018 Plenary, *Genesis*, Toyama, Japan
37. 09/2018 Plenary, *NOW2018*, Ostuni, Italy
36. 09/2018 Invited Talk, *Anisotropic Universe*, Torino, Italy
35. 04/2018 Plenary, *DM: paradigm confirmation or shift?*, KITP
34. 02/2018 Invited Talk, *Pacific 2018*, Hokkaido, Japan

33. 06/2017 Plenary, *Fifty One Ergs 2017*, Oregon State University
32. 05/2017 Plenary, *NEUCOS 2017*, DESY, Germany
31. 03/2017 Invited Talk, *Neutrinos: the quest for a new physics scale*, CERN
30. 02/2017 Invited Talk, *30 years from SN1987A and the future*, University of Tokyo
29. 01/2017 Plenary, *American Physical Society April Meeting*, Washington DC
28. 12/2016 Plenary, *8th Symposium on Large TPCs for Low Energy Rare Events*, Paris
27. 12/2016 Plenary, *Fifth AMON Workshop*, Penn State University
26. 08/2016 Invited Talk, *38th International Conference on High Energy Physics*, Chicago
25. 06/2016 Plenary, *Multi-messenger Approaches to CRs: Origins and Space Frontiers*, Penn State University
24. 06/2016 Invited Talk, *Lepton-Nucleon Scattering XIV*, Elba, Italy
23. 03/2016 Plenary, *Spring Meeting of The Astronomical Society of Japan*, Tokyo, Japan
22. 01/2016 Plenary, *The Second Supernova Neutrino Workshop*, Toyama, Japan
21. 12/2015 Plenary, *Gamma rays and Dark Matter 2015*, Obergurgl, Austria
20. 06/2015 Plenary, *Particle Physics and Cosmology 2015*, Deadwood, South Dakota
19. 06/2015 Invited Talk, *Neutrino Astrophysics and Fundamental Properties*, Institute for Nuclear Theory, University of Washington
18. 05/2015 Invited Talk, *DM Searches with the EGB*, University of Tokyo
17. 05/2015 Invited Talk, *Astrophysics with Hyper-Kamiokande*, Kobe University
16. 12/2014 Invited Talk, *Present and Future Neutrino Physics*, KITP
15. 04/2014 Plenary, *APS April Meeting*, Savanna, Georgia
14. 02/2014 Invited Talk, *Cosmic Neutrino PeVatron*, Chiba, Japan
13. 12/2013 Plenary, *Multi-Messengers from Core-Collapse Supernovae*, Fukuoka, Japan
12. 11/2013 Invited Talk, *MACROS*, Institut d'Astrophysique de Paris, France
11. 11/2013 Plenary, *NNN 2014*, Kavli IPMU, Japan
10. 09/2013 Invited Talk, *PACIFIC 2013*, Moorea, French Polynesia
9. 04/2013 Plenary, *Second PANDA Symposia series: Wide-field astronomy*, Xi'an, China
8. 01/2013 Invited Panelist, *Dark Matter in Southern California*, Caltech
7. 08/2012 Plenary, *International Open Meeting for the Hyper-K Project*, Kavli IMPU, Japan
6. 08/2012 Invited Talk, *GeV Neutrino workshop*, Ohio State University
5. 04/2011 Invited Talk, *CCAPP Symposium*, Ohio State University
4. 02/2011 Invited Talk, *SnowPAC 2011*, Snowbird, Utah
3. 12/2010 Plenary, *NNN 2010*, Toyama, Japan
2. 10/2009 Invited Talk, *CCAPP Inaugural Symposium*, Ohio State University
1. 06/2009 Invited Talk, *Dark side of the Universe*, University of Melbourne, Australia

## Mentoring

### *Postdoc mentoring:*

- 2023 – Gonzalo Herrera
- 2022 – Garv Chauhan
- 2020 – 2021 Francesco Capozzi (→ Faculty at University of L'Aquila)
- 2020 – 2021 Mukul Bhattacharya (→ Eberly Research Fellow at Penn State University)
- 2020 – 2021 Zahra Tabrizi (→ NTN Research Fellow, Northwestern University)
- 2019 – 2022 Natalia Tapia (→ Postdoct at University of Utah)
- 2015 – 2018 Oscar Macias (→ Faculty at San Francisco State University)
- 2015 – 2017 John Cherry (→ Postdoct at University of South Dakota)

*Graduate mentoring:*

- 2021 – Sarah Healy (Virginia Tech)
- 2020 – Sean Heston (Virginia Tech)
- 2019 – Nick Ekanger (Virginia Tech)
- 2018 – 2021 Varun Mathur (Virginia Tech, with Ian Shoemaker)
- 2018 – 2021 Tommy Lam (Virginia Tech) → Belle II
- 2016 – 2021 Deheng Song (Virginia Tech → YITP, Japan)
- 2016 – 2019 Chris Castillo (Virginia Tech, with Duncan Farrah → finance)
- 2015 – 2017 Jonathan Baker (Virginia Tech → defense)
- 2013 – 2016 Anna Kwa (UC Irvine, with Manoj Kaplinghat → data science)
- 2013 – 2015 Nicolas Canac (UC Irvine, with Kevork Abazajian → data science)
- 2011 – 2015 Nathan Griffith (Ohio State University, with Amy Connolly → industry)
- 2011 – 2013 Ranjan Laha (Ohio State University, with John Beacom → Stanford University)
- 2010 – 2015 Kenny Ng (Ohio State University, with John Beacom → Weizmann Institute)

*Undergraduate mentoring:*

- 2023 – Maria Carrillo (Virginia Tech)
- 2022 – Alex Drummond (Virginia Tech)
- 2021 Sami Reitz (Radford University), REU student
- 2020 – Zachary Hoelscher (Virginia Tech → Georgia Tech)
- 2020 – 2021 Nathan Rand (Virginia Tech)
- 2020 Emily Kehoe (Clarkson University → UCLA), REU student
- 2019 – 2020 Youyou Li (Virginia Tech → University of Copenhagen)
- 2019 Grace Dunleavy (Drake University), REU student
- 2018 – 2020 Lia Compton (Virginia Tech → Colorado State University)
- 2018 – 2019 Ahmad Abushaban (Virginia Tech → consulting)
- 2018 – 2019 Nick Ekanger (Virginia Tech → Virginia Tech)
- 2018 – 2019 Andrew Walker (Virginia Tech → Virginia Tech)
- 2018 Zeshen Li (Virginia Tech → Columbia University)
- 2018 Duncan Jones (Virginia Tech → industry)
- 2017 – 2018 Matthew La Rosa (Virginia Tech → industry)
- 2017 – 2018 Kaiyang Zhang (Virginia Tech → industry)
- 2017 Christian Gilbertson (Virginia Tech → Penn State University)
- 2017 Joseph Weissman (Virginia Tech → industry)
- 2017 Carlos Magana (Virginia Tech → education)
- 2016 – 2017 Alex Nikrant (Virginia Tech → Virginia Tech)
- 2016 George Lewandowski (Virginia Tech)
- 2015 – 2017 Alex Gagliano (Virginia Tech → University of Illinois at Urbana-Champaign)
- 2015 Bryan Calloway (Virginia Tech → Cornell University)
- 2015 – 2016 Laura Wishart (Virginia Tech → Virginia Tech)
- 2015 – 2016 Keegan Walkup (Virginia Tech → Virginia Tech)



## Courses Taught

- 2023 PHYS 5455: *Graduate quantum mechanics*
- 2022 PHYS 4984/5984: *SS: Astroparticle Physics*
- 2021 PHYS 4654/5654: *Modern Cosmology*
- 2020 PHYS 4984/5984: *SS: Astroparticle Physics*
- 2020 PHYS 4654/5654: *Modern Cosmology*
- 2019 PHYS 4984/5984: *SS: Astroparticle Physics*
- 2019 PHYS 4654/5654: *Modern Cosmology*
- 2019 PHYS 4455: *Introduction to quantum mechanics Part I*
- 2018 PHYS 4455, 4456: *Introduction to quantum mechanics Parts I & II*
- 2017 PHYS 4455, 4456: *Introduction to quantum mechanics Parts I & II*
- 2016 PHYS 4455, 4456: *Introduction to quantum mechanics Parts I & II*
- 2015 PHYS 4455, 4456: *Introduction to quantum mechanics Parts I & II*