

Shunsaku Horiuchi

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Research Interests

Dark matter: astrophysical and cosmological probes of particle dark matter

Supernovae: multi-messenger signatures, including cosmic ray, gamma ray, and neutrinos

Appointments

2020 –	Associate Professor	Virginia Tech
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

Below is a list of publications excluding those with large collaborations.

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*, arXiv:2005.06488, 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*, arXiv:2003.10416, Phys. Rev. **D102** 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*, arXiv:1912.11489, Phys. Rev. **D102** 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*, arXiv:1911.11841, Phys. Rev. **D101** 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*, arXiv:1908.10594, J. Cosmol. Astropart. Phys. **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*, arXiv:1908.09037, Phys. Rev. **D101** 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*, arXiv:1907.01002, Phys. Rev. **D101** 6, 063027

49. Song, D., Macias, O., **Horiuchi, S.**, 2019, *Inverse-Compton emission from Millisecond Pulsars in the Galactic bulge*, Phys. Rev. **D99** 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*, J. Cosmol. Astropart. Phys. **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. **D99** 083005.
46. Ammazzalorso, S., Fornengo, N., **Horiuchi, S.**, Regis, M., 2018, *Characterizing the local gamma-ray Universe via angular cross-correlations*, Phys. Rev. **D98** 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. **D97** 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. **D97** 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 $88-100M_{\odot}-100M_{\odot}$ progenitors*, Mon. Not. Roy. Astron. Soc. **475**, 1363
40. Nikrant, A., Laha, R., **Horiuchi, S.**, 2018, *Robust measurement of supernova ν_e spectra with future neutrino detectors*, Phys. Rev. **D97**, 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*, arXiv:1709.01515, 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. **G45** 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. **G44** no.11, 114001
36. Cherry, J. F., **Horiuchi, S.**, 2017, *Closing in on Resonantly Produced Sterile Neutrino Dark Matter*, Phys. Rev. **D95**, 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 Astronomy 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. **D95**, 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. **D94**, 063522
 31. **Horiuchi, S.**, Kaplinghat, M., Kwa, A., 2016, *Investigating the Uniformity of the Excess Gamma rays towards the Galactic Center Region*, J. Cosmol. Astropart. Phys. **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*, J. Cosmol. Astropart. Phys. **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. **D92**, 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. **D92**, 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*, J. Cosmol. Astropart. Phys. **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. **D91**, 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. **D90**, 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. **D90**, 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. **D89**, 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. **D89**, 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. **D88**, 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. **D87**, 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. **D81**, 103005
5. **Horiuchi, S.**, Beacom, J. F., Dwek, E., 2009, *The Diffuse Supernova Neutrino Background is detectable in Super-Kamiokande*, Phys. Rev. **D79**, 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. **D77**, 063007
2. Yuksel, H., **Horiuchi, S.**, Beacom, J. F., *et. al.*, 2007, *Neutrino Constraints on the Dark Matter Total Annihilation Cross Section*, Phys. Rev. **D76**, 123506
1. **Horiuchi, S.** & Ando, S., 2006, *Dark matter annihilation from intermediate-mass black holes: Contribution to the extragalactic gamma-ray background*, Phys. Rev. **D74**, 103504

Invited Conference Talks

46. 01/2020 Invited Talk, *16th Rencontres du Vietnam*, Quy Nhon, 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, *32nd 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*
Ikaho, 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 Astrophysical Multi-messenger Observatory Network 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, *14th International Workshop on Next generation Nucleon Decay and Neutrino Detectors*, 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-Kamiokande 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, *11th International Workshop on Next generation Nucleon Decay and Neutrino Detectors*, 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