

# Shunsaku Horiuchi

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## Research Interests

Dark matter physics: astrophysical and cosmological probes of particle dark matter  
Supernova physics: cosmic-ray, gamma-ray, and neutrino signatures  
Supernova rates: and their connection to star formation

## Appointments

2014 –	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

## Teaching and Mentoring

### *Postdoc mentoring:*

2015 –	Oscar Macias (Virginia Tech)
2015 –	JJ Cherry (Virginia Tech)

### *Graduate mentoring:*

2016 –	Chris Castillo (Virginia Tech)
2015 –	Jonathan Baker (Virginia Tech)
2013 – 2016	Anna Kwa (UC Irvine, with Prof. Manoj Kaplinghat)
2013 – 2015	Nicolas Canac (UC Irvine, with Prof. Kevork Abazajian)
2011 – 2015	Nathan Griffith (The Ohio State University, with Prof. Amy Connolly)
2011 – 2013	Ranjan Laha (The Ohio State University, with Prof. John Beacom)
2010 – 2015	Kenny Ng (The Ohio State University, with Prof. John Beacom)

### *Undergraduate mentoring:*

2017 –	Christian Gilbertson (Virginia Tech)
2017 –	Joseph Weissman (Virginia Tech)
2017 –	Carlos Magana (Virginia Tech)
2016 –	Alex Nikrant (Virginia Tech)
2015 –	Alex Gagliano (Virginia Tech)
2016 – 2016	George Lewandowski (Virginia Tech)
2015 – 2016	Laura Wishart (Virginia Tech)
2015 – 2016	Keegan Walkup (Virginia Tech)

### *Teaching:*

2015 – 2017	PHYS 4455, 4456: <i>Introduction to quantum mechanics Parts I &amp; II</i>
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## Publications

*Summary:* As of Feb 2027, 45 citable papers with 1717 citations and  $h$ -index of 23 [from inspire].

40. Cherry, J., **Horiuchi, S.**, 2017, *Closing in on Resonantly Produced Sterile Neutrino Dark Matter*, arXiv:1701.07874, submitted to PRD
39. Macias, O., Gordon, C., Crocker, R., Coleman, B., Paterson, D., **Horiuchi, S.**, Pohl, M., 2016, *Discovery of Gamma-Ray Emission from the X-shaped Bulge of the Milky Way*, arXiv:1611.06644
38. Hyper-Kamiokande proto-Collaboration (including **Horiuchi, S.**), 2016, *Physics Potentials with the Second Hyper-Kamiokande Detector in Korea*, arXiv:1611.06118
37. Perez, K., Ng, K., Beacom, J., Hersh, C., **Horiuchi, S.**, Krivonos, R., 2016, *(Almost) Closing the Sterile Neutrino Dark matter Window with NuSTAR*, arXiv:1609.00667, submitted to PRD
36. Ankowski, A., Beacom, J., Benhar, O., Chen, S., Cherry, J., Cui, Y., Friedland, A., Botella, I., Haghighat, A., **Horiuchi, S.**, 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
35. 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
34. **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
33. **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
32. 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
31. 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
30. **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
29. Shirasaki, M., **Horiuchi, S.**, Yoshida, Y., 2015, *Cross-Correlation of the Extragalactic Gamma-ray Background with Luminous Red Galaxies*, Phys. Rev. **D92**, 123540
28. 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]
27. Hyper-Kamiokande Proto-Collaboration (including **Horiuchi, S.**), 2015, *Physics potential of a long-baseline neutrino oscillation experiment using a J-PARC neutrino beam and Hyper-Kamiokande*, Prog. Theor. Eep. Phys. **5**, 053C02
26. 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
25. **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
24. Bell, N. F., **Horiuchi, S.**, Shoemaker, I. M., 2015, *Annihilating Asymmetric Dark Matter*, Phys. Rev. **D91**, 023505
  23. 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
  22. 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
  21. 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
  20. **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
  19. 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
  18. Hyper-Kamiokande Working Group Collaboration (including **Horiuchi, S.**), 2013, *Hyper-Kamiokande Physics Opportunities*, arXiv:1309.0184
  17. 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
  16. 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
  15. **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
  14. 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
  13. 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
  12. **Horiuchi, S.**, Murase, K., Ioka, K., Meszaros, P., 2012, *The survival of nuclei in jets associated with core-collapse supernovae*, Astrophys. J. **753**, 69
  11. LENA Collaboration (including **Horiuchi, S.**), 2012, *The next-generation liquid-scintillator neutrino observatory LENA*, Astropart. Phys. **35**, 685
  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

## Service

- 2016 Organizer of *Supernova Physics at DUNE*, Virginia Tech
- 2015 Organizer of *Multi-messengers from core-collapse supernovae 2015*, Virginia Tech
- 2014 – 2017 Center for Neutrino Physics seminar coordinator, Virginia Tech
- 2014 Chair of *Supernovae and Gamma Ray Bursts* session, APS April meeting
- 2013 Co-organizer of *TeV Particle Astrophysics 2013*, UC Irvine
- 2012 Co-organizer of *Revealing Deaths of Massive Stars with GeV-TeV Neutrinos*, Ohio State University
- 2011 – 2012 CCAPP seminar coordinator, Ohio State University
- 2011 Co-organizer of *CCAPP Symposium: Unraveling the Nature of the Universe with Current and Future Datasets*, Ohio State University
- 2010 – 2012 Founder and organizer of *Astro Lunch*, Ohio State University
- 2009 – Referee for *Astrophysical Journal*, *Astrophysical Journal Letter*, *Astrophysical Journal Supplement*, *Physical Review D*, *Physical Review Letters*, and *Monthly Notices of the Royal Astronomical Society*
- 2008 Session convener at *The 38th Summer School for Astronomy & Astrophysics*

## Invited Seminars and Conference Talks

*Summary:* As of Feb 2017, 45 invited talks since Jan 2013 (plus 4 upcoming)

- 07/2017 Invited Talk, *Exploring the Dark Universe 2017*, Rencontres de Moriond and Rencontres du Vietnam
- 06/2017 Invited Talk, *Fifty One Ergs 2017*, Oregon State University
- 05/2017 Invited Talk, *Particle Physics and Cosmology 2017*, Texas A & M University
- 03/2017 Invited Talk, *Neutrinos: the quest for a new physics scale*, CERN
- 02/2017 Seminar, *Particle Physics Seminars*, Cornell University
- 02/2017 Invited Talk, *30 years from SN1987A and the future*, University of Tokyo
- 01/2017 Invited Talk, *American Physical Society April Meeting*, Washington DC
- 12/2016 Invited Talk, *8th Symposium on Large TPCs for Low Energy Rare Events*, Paris
- 12/2016 Invited Talk, *Fifth Astrophysical Multi-messenger Observatory Network Workshop*, Penn State University
- 09/2016 Public Talk, *Society of Physics Students*, Virginia Tech
- 08/2016 Invited Talk, *38th International Conference on High Energy Physics*, Chicago
- 07/2016 Seminar, *Astroparticle Seminars and Lectures*, University of Torino
- 06/2016 Invited Talk, *Multi-messenger Approaches to CRs: Origins and Space Frontiers*,

Penn State University

- 06/2016 Invited Talk, *Lepton-Nucleon Scattering XIV*, Elba, Italy
- 04/2016 Seminar, *Astrophysics Seminar*, Virginia Tech
- 04/2016 Seminar, *High-Energy Physics & Astrophysics Seminar*, Penn State University
- 03/2016 Invited Talk, *Spring Meeting of The Astronomical Society of Japan*, Tokyo, Japan
- 02/2016 Seminar, *Triangle Nuclear Theory Seminar*, NC State University
- 01/2016 Seminar, *Astrophysical Big Bang Laboratory*, RIKEN, Japan
- 01/2016 Invited Talk, *The Second Supernova Neutrino Workshop*, Toyama, Japan
- 12/2015 Invited Talk, *Gamma rays and Dark Matter 2015*, Obergurgl, Austria
- 07/2015 Seminar, *Particle Physics Seminar*, Duke University
- 06/2015 Invited Talk, *Particle Physics and Cosmology 2015*, Deadwood, South Dakota
- 06/2015 Invited Talk, *Neutrino Astrophysics and Fundamental Properties*, Institute for Nuclear Theory, University of Washington
- 05/2015 Invited Talk, *DM Searches with the EGB*, University of Tokyo
- 05/2015 Invited talk, *Astrophysics with Hyper-Kamiokande*, Kobe University
- 04/2015 Seminar, *Department of Physics*, University of Virginia
- 12/2014 Invited Talk, *Present and Future Neutrino Physics*, KITP
- 06/2014 Invited Talk, *Chalonge Meudon Workshop*, Paris, France
- 04/2014 Invited Talk, *APS April Meeting*, Savanna, Georgia
- 03/2014 Colloquium, *Theoretical Astrophysics Program*, University of Arizona
- 02/2014 Colloquium, *Department of Physics*, Virginia Tech
- 02/2014 Invited Talk, *Cosmic Neutrino PeVatron*, Chiba, Japan
- 01/2014 Seminar, *DARK Cosmology Centre*, Niels Bohr Institute, University of Copenhagen
- 12/2013 Seminar, *Astrophysics and Cosmology*, Kavli IPMU
- 12/2013 Seminar, *Theoretical Astrophysics*, University of Tokyo
- 12/2013 Invited Talk, *Multi-Messengers from Core-Collapse Supernovae*, Fukuoka, Japan
- 11/2013 Invited Talk, *MACROS*, Institut d'Astrophysique de Paris, France
- 11/2013 Seminar, *Department of Physics*, Tokyo University of Science
- 11/2013 Invited Talk, *14th International Workshop on Next generation Nucleon Decay and Neutrino Detectors*, Kavli IPMU, Japan
- 09/2013 Invited Talk, *PACIFIC 2013*, Moorea, French Polynesia
- 06/2013 Seminar, *Theoretical Elementary Particle Physics*, UCLA
- 04/2013 Invited Talk, *Second PANDA Symposia series: Wide-field astronomy*, Xi'an, China
- 04/2013 Symposium, *Nuclear Astrophysics*, Caltech
- 04/2013 Seminar, *FLASH*, UC Santa Cruz
- 03/2013 Seminar, *Sydney Institute for Astrophysics*, Sydney University
- 02/2013 Colloquium, Australian Astronomical Observatory
- 02/2013 Seminar, *Particle-astrophysics*, University of Melbourne
- 01/2013 Invited Panelist, *Dark Matter in Southern California*, Caltech
- 08/2012 Invited Talk, *International Open Meeting for the Hyper-Kamiokande Project*, Kavli IMPU, Japan
- 08/2012 Invited Talk, *GeV Neutrino workshop*, Ohio State University
- 05/2012 Seminar, *QFPU Topic 2*, Nagoya University
- 02/2012 Seminar, *TAPIR*, Caltech
- 11/2011 Seminar, *Center for Cosmology*, UC Irvine
- 09/2011 Seminar, *Center for Particle and Gravitational Astrophysics*, Penn State University
- 08/2011 Seminar, *Cosmophysics*, High-Energy Accelerator Research Organization (KEK)
- 04/2011 Invited Talk, *CCAPP Symposium*, Ohio State University

- 03/2011 Seminar, *Center for Particle Astrophysics*, Fermilab
- 02/2011 Seminar, *Subatomic Physics Group*, Los Alamos National Laboratory
- 02/2011 Invited Talk, *SnowPAC 2011*, Snowbird, Utah
- 01/2011 Seminar, *Department of Astronomy*, University of Texas at Austin
- 12/2010 Seminar, *Theory Division*, National Astronomical Observatory of Japan
- 12/2010 Invited Talk, *11th International Workshop on Next generation Nucleon Decay and Neutrino Detectors*, Toyama, Japan
- 03/2010 Seminar, *Cosmology Series*, KIPAC & Stanford University
- 02/2010 Seminar, *Astroparticle and Cosmology Group*, Arizona State University
- 10/2009 Invited Talk, *CCAPP Inaugural Symposium*, Ohio State University
- 07/2009 Seminar, *Theory Group*, Max-Planck Institute for Physics
- 06/2009 Seminar, *High Energy Astrophysics Group*, Waseda University
- 06/2009 Invited Talk, *Dark side of the Universe*, University of Melbourne, Australia
- 05/2009 Seminar, *Astrophysics Group*, IPMU
- 04/2009 Seminar, *Cosmophysics*, High-Energy Accelerator Research Organization (KEK)
- 10/2008 Seminar, *Institute of Theoretical Physics*, Rikkyo University
- 09/2008 Seminar, *Center of Cosmology and AstroParticle Physics*, Ohio State University
- 03/2007 Seminar, *Theoretical Astrophysics Group*, University of Tokyo

## Contributed Conference Talks & Posters

- 08/2016 Talk, *Flavor Observations with Supernova Neutrinos*, Institute for Nuclear Theory, University of Washington
- 11/2015 Poster, *Sixth International Fermi Symposium*, Arlington, VA
- 02/2015 Talk, *Future Space-based Gamma-ray Observatories*, NASA Goddard
- 10/2014 Plenary Talk, *Fifth International Fermi Symposium*, Nagoya, Japan
- 04/2014 Talk, *Progress on Old and New Themes in Cosmology 2014*, Avignon, France
- 02/2014 Talk, *Dark Matter 2014*, UCLA
- 02/2013 Poster, *New Directions in Neutrino Physics*, Aspen
- 06/2012 Poster, *Neutrino 2012*, Kyoto, Japan
- 08/2011 Talk, *TeV Particle Astrophysics 2011*, Stockholm, Sweden
- 06/2010 Talk, *IAP Colloquium Progenitors and environments of stellar explosions*, Institut d'Astrophysique de Paris, France
- 03/2009 Talk, *Japan Astronomical Society Spring Conference*, Osaka Pref. University, Japan
- 02/2009 Talk, *Core-collapse Supernovae and High-energy Astronomy*, Tokyo University, Japan
- 12/2008 Talk, *21st Rironkon Symposium*, National Astronomical Observatory of Japan
- 04/2008 Talk, *RESCEU Symposium on Astroparticle Physics and Cosmology*, Tokyo, Japan
- 03/2008 Talk, *14th Workshop on Nuclear Astrophysics*, Ringberg Castle, Germany
- 03/2008 Talk, *Japan Astronomical Society Spring Conference*, Olympic Centre, Japan
- 11/2007 Talk, *COE Symposium*, University of Tokyo, Japan
- 09/2007 Talk, *Japan Physics Society Autumn Conference*, Hokkaido University, Japan
- 09/2007 Talk, *Topics in Astroparticle and Underground Physics*, Sendai, Japan
- 08/2007 Talk, *TeV Particle Astrophysics 2007*, Venice, Italy
- 03/2007 Talk, *Japan Astronomical Society Spring Conference*, Tokai University, Japan
- 03/2007 Talk, *Japan Physics Society Spring Conference*, Tokyo Metropolitan University, Japan
- 12/2006 Poster, *19th Rironkon Symposium*, Rikkyo University, Japan
- 09/2006 Talk, *RESCEU Workshop*, Kinugawa Convention Hall, Japan

03/2006 Poster, *High-energy Astrophysics in the Next Decade*, ICRC, Japan  
03/2006 Talk, *Japan Astronomical Society Spring Conference*, Wakayama, Japan