

# Kiyoshi Wesley Masui

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September 19, 2019

## Personal Information

Citizenship Canadian  
Languages English, French

## Education

- 2013 Ph.D., Physics, University of Toronto  
Thesis: “Advancing precision cosmology with 21 cm intensity mapping”  
Advisor: Ue-Li Pen
- 2008 B.Sc.E., Engineering Physics, Queen’s University at Kingston, First class honours  
Thesis: “Radioactively inert argon”  
Advisor: Arthur B. McDonald

## Professional Appointments

- 2018 – present Assistant Professor, Massachusetts Institute of Technology, Department of Physics
- 2016 – 2018 Canadian Institute for Theoretical Astrophysics National Fellow, University of British Columbia, Department of Physics and Astronomy
- 2013 – 2015 Canadian Institute for Advanced Research Global Scholar, University of British Columbia, Department of Physics and Astronomy
- 2013 – 2018 Postdoctoral Fellow, University of British Columbia, Department of Physics and Astronomy

## Honors and Awards

- 2019 Teaching with Digital Technology Award, Nomination, Massachusetts Institute of Technology
- 2016 – 2018 National Fellow, Canadian Institute for Theoretical Astrophysics
- 2013 – 2015 Global Scholar, Canadian Institute for Advanced Research
- 2012 – 2013 Walter C. Sumner Memorial Fellowship, Walter C. Sumner Foundation
- 2012 Van Kranendonk Teaching Award, University of Toronto, Department of Physics
- 2010 – 2012 Alexander Graham Bell Canada Graduate Scholar—Doctoral, Natural Sciences and Engineering Research Council of Canada
- 2008 – 2010 Canada Graduate Scholar—Master’s, Natural Sciences and Engineering Research Council of Canada
- 2006 – 2008 Dean’s Award, Queen’s University at Kingston

- 2004 – 2006 Principal’s Scholarship, Queen’s University at Kingston
- 2004 Nortel Networks’ Scholarship, Queen’s University at Kingston
- 2004 Governor General’s Academic Metal

## Publications

### Journal Articles

- 2019 CHIME/FRB Collaboration, B. C. Andersen, K. Bandura, *et al.*, “CHIME/FRB Detection of Eight New Repeating Fast Radio Burst Sources”, submitted to *Astrophys. J. Lett.* (2019), [arXiv:1908.03507](#).
- 2019 A. Josephy, P. Chawla, E. Fonseca, *et al.*, “CHIME/FRB Detection of the Original Repeating Fast Radio Burst Source FRB 121102”, submitted to *Astrophys. J.* (2019), [arXiv:1906.11305 \[astro-ph.HE\]](#).
- 2019 **K. W. Masui**, J. R. Shaw, C. Ng, K. M. Smith, K. Vanderlinde, and A. Paradise, “Algorithms for FFT Beamforming Radio Interferometers”, *Astrophys. J.* **879**, 16 (2019).
- 2019 CHIME/FRB Collaboration, M. Amiri, K. Bandura, *et al.*, “A second source of repeating fast radio bursts”, *Nature* **566**, 235 (2019), [arXiv:1901.04525](#).
- 2019 CHIME/FRB Collaboration, M. Amiri, K. Bandura, *et al.*, “Observations of fast radio bursts at frequencies down to 400 megahertz”, *Nature* **566**, 230 (2019), [arXiv:1901.04524](#).
- 2019 J. Taylor, N. Denman, K. Bandura, P. Berger, **K. Masui**, A. Renard, I. Tretyakov, and K. Vanderlinde, “Spectral kurtosis-based rfi mitigation for chime”, *Journal of Astronomical Instrumentation* **8**, 1940004 (2019), [arXiv:1808.10365](#).
- 2018 CHIME/FRB Collaboration, M. Amiri, K. Bandura, *et al.*, “The CHIME Fast Radio Burst Project: System Overview”, *Astrophys. J.* **863**, 48 (2018), [arXiv:1803.11235](#).
- 2018 C. J. Anderson, N. J. Luciw, Y.-C. Li, *et al.*, “Low-amplitude clustering in low-redshift 21-cm intensity maps cross-correlated with 2dF galaxy densities”, *Mon. Not. R. Astron. Soc.* **476**, 3382 (2018), [arXiv:1710.00424](#).
- 2018 R. Hill, **K. W. Masui**, and D. Scott, “The Spectrum of the Universe”, *Applied Spectroscopy*, [0003702818767133](#) (2018), [arXiv:1802.03694](#).
- 2018 H.-H. Lin, **K. Masui**, U.-L. Pen, and J. B. Peterson, “Improved pulsar timing via principal component mode tracking”, *Mon. Not. R. Astron. Soc.* **475**, 1323 (2018), [arXiv:1707.08581](#).
- 2017 L. Wolz, C. Blake, F. B. Abdalla, *et al.*, “Erasing the Milky Way: new cleaning technique applied to GBT intensity mapping data”, *Mon. Not. R. Astron. Soc.* **464**, 4938 (2017), [arXiv:1510.05453](#).
- 2017 M. Amiri, K. Bandura, P. Berger, *et al.*, “Limits on the Ultra-bright Fast Radio Burst Population from the CHIME Pathfinder”, *Astrophys. J.* **844**, 161 (2017), [arXiv:1702.08040](#).
- 2017 **K. W. Masui**, U.-L. Pen, and N. Turok, “Two- and Three-Dimensional Probes of Parity in Primordial Gravity Waves”, *Phys. Rev. Lett.* **118**, 221301 (2017), [arXiv:1702.06552](#).
- 2016 Y.-W. Liao, T.-C. Chang, C.-Y. Kuo, **K. W. Masui**, N. Oppermann, U.-L. Pen, and J. B. Peterson, “Accurate Polarization Calibration at 800 MHz with the Green Bank Telescope”, *Astrophys. J.* **833**, 289 (2016), [arXiv:1610.04365](#).

- 2016 L. Connor, H.-H. Lin, **K. Masui**, N. Oppermann, U.-L. Pen, J. B. Peterson, A. Roman, and J. Sievers, “Constraints on the FRB rate at 700-900 MHz”, *Mon. Not. R. Astron. Soc.* **460**, 1054 (2016), [arXiv:1602.07292](#).
- 2015 **K. Masui**, H.-H. Lin, J. Sievers, *et al.*, “Dense magnetized plasma associated with a fast radio burst”, *Nature* **528**, 523 (2015), [arXiv:1512.00529](#).
- 2015 **K. W. Masui** and K. Sigurdson, “Dispersion Distance and the Matter Distribution of the Universe in Dispersion Space”, *Phys. Rev. Lett.* **115**, 121301 (2015), [arXiv:1506.01704](#).
- 2015 E. R. Switzer, T.-C. Chang, **K. W. Masui**, U.-L. Pen, and T. C. Voytek, “Interpreting the Unresolved Intensity of Cosmologically Redshifted Line Radiation”, *Astrophys. J.* **815**, 51 (2015), [arXiv:1504.07527](#).
- 2015 **K. Masui**, M. Amiri, L. Connor, *et al.*, “A compression scheme for radio data in high performance computing”, *Astronomy and Computing* **12**, 181 (2015), [arXiv:1503.00638](#).
- 2013 E. R. Switzer, **K. W. Masui**, K. Bandura, *et al.*, “Determination of  $z \sim 0.8$  neutral hydrogen fluctuations using the 21 cm intensity mapping autocorrelation”, *Mon. Not. R. Astron. Soc.* **434**, L46 (2013), [arXiv:1304.3712](#).
- 2013 **K. W. Masui**, E. R. Switzer, N. Banavar, *et al.*, “Measurement of 21 cm Brightness Fluctuations at  $z \sim 0.8$  in Cross-correlation”, *Astrophys. J. Lett.* **763**, L20 (2013), [arXiv:1208.0331](#).
- 2010 **K. W. Masui** and U.-L. Pen, “Primordial Gravity Wave Fossils and Their Use in Testing Inflation”, *Phys. Rev. Lett.* **105**, 161302 (2010), [arXiv:1006.4181](#).
- 2010 **K. W. Masui**, P. McDonald, and U.-L. Pen, “Near-term measurements with 21 cm intensity mapping: Neutral hydrogen fraction and BAO at  $z < 2$ ”, *Phys. Rev. D* **81**, 103527 (2010), [arXiv:1001.4811](#).
- 2010 **K. W. Masui**, F. Schmidt, U.-L. Pen, and P. McDonald, “Projected constraints on modified gravity cosmologies from 21 cm intensity mapping”, *Phys. Rev. D* **81**, 062001 (2010), [arXiv:0911.3552](#).
- 2008 S. P. Pecknold, **K. W. Masui**, and P. C. Hines, “Transmission loss measurements and geoacoustic sensitivity modeling at 1.2 kHz”, *The Journal of the Acoustical Society of America* **124**, EL110 (2008).

### Conference Proceedings

- 2017 C. Ng, K. Vanderlinde, A. Paradise, *et al.*, “CHIME FRB: An application of FFT beamforming for a radio telescope”, in *XXXII<sup>nd</sup> General Assembly & Scientific Symposium*, International Union of the Radio Science (URSI) (Aug. 2017), [arXiv:1702.04728](#).
- 2016 P. Berger, L. B. Newburgh, M. Amiri, *et al.*, “Holographic Beam Mapping of the CHIME Pathfinder Array”, in *Ground-based and Airborne Telescopes VI*, Vol. 9906, Society of Photo-Optical Instrumentation Engineers (SPIE) Conference Series (Aug. 2016), [arXiv:1607.01473](#).
- 2015 N. Denman, M. Amiri, K. Bandura, *et al.*, “A GPU-based Correlator X-engine Implemented on the CHIME Pathfinder”, in *Application-specific Systems, Architectures and Processors*, Institute of Electrical and Electronics Engineers (IEEE) International Conference Series (July 2015), [arXiv:1503.06202](#).
- 2014 K. Bandura, G. E. Addison, M. Amiri, *et al.*, “Canadian Hydrogen Intensity Mapping Experiment (CHIME) pathfinder”, in *Ground-based and Airborne Telescopes V*, Vol. 9145, Society of Photo-Optical Instrumentation Engineers (SPIE) Conference Series (July 2014), [arXiv:1406.2288](#).

- 2014 L. B. Newburgh, G. E. Addison, M. Amiri, *et al.*, “Calibrating CHIME: a new radio interferometer to probe dark energy”, in [Ground-based and Airborne Telescopes V](#), Vol. 9145, Society of Photo-Optical Instrumentation Engineers (SPIE) Conference Series (July 2014), [arXiv:1406.2267](#).

### White Papers

- 2019 K. Bandura, E. Castorina, L. Connor, *et al.*, “Packed Ultra-wideband Mapping Array (PUMA): A Radio Telescope for Cosmology and Transients”, Astro2020 Decadal Survey: APC White Papers, [arXiv:1907.12559](#) (2019), [arXiv:1907.12559](#).
- 2018 Cosmic Visions 21 cm Collaboration, R. Ansari, E. J. Arena, *et al.*, “Inflation and Early Dark Energy with a Stage II Hydrogen Intensity Mapping experiment”, Department of Energy Cosmic Visions Dark Energy Program (2018), [arXiv:1810.09572](#).
- 2010 U.-L. Pen, J. R. Bond, M. Halpern, *et al.*, “21 cm Cosmology”, [Canadian Astronomical Society Long Range Plan 2010](#) (2010).

## Teaching

### Courses Taught

- 2019 Cosmology, Massachusetts Institute of Technology
- 2019 Physics II: Electricity and Magnetism, Massachusetts Institute of Technology
- 2018 Physics I: Classical Mechanics, Massachusetts Institute of Technology

### Teaching Assistantships

- 2012 – 2013 Physics Drop in Centre, University of Toronto
- 2012 Foundations of Physics II, University of Toronto
- 2011 Foundations of Physics I, University of Toronto
- 2011 Quantum and Thermal Physics, University of Toronto
- 2009 Introduction to Physics I, University of Toronto
- 2009 Introduction to Physics II, University of Toronto

### Faculty Sponsor

- 2017 – 2018 Engineering Physics Project I, University of British Columbia

## Supervision and Mentorship

### Postdoctoral Supervision

- 2019 – present Tianyue Chen, Massachusetts Institute of Technology

### Graduate Research Supervision

- 2019 – present Haochen Wang, Massachusetts Institute of Technology
- 2018 – present Kaitlyn Shin, Massachusetts Institute of Technology
- 2018 – present Calvin Leung, Massachusetts Institute of Technology

## Undergraduate Research Supervision

- 2018 – 2019 Ellen Lee, Massachusetts Institute of Technology
- 2017 Tara Akhound-Sadegh, University of British Columbia
- 2011 – 2012 Nidhi Banavar, University of Toronto
- 2011 – 2012 Liviu-Mihai Calin, University of Toronto

## Graduate Student Mentorship

- 2016 – present Tristan Pinsonneault-Marotte, University of British Columbia
- 2015 – 2017 Liam Connor, University of Toronto
- 2014 – present Deborah Good, University of British Columbia
- 2014 – present Hsiu-Hsien Lin, Carnegie Mellon University
- 2013 – present Carolin Höfer, University of British Columbia
- 2012 – 2017 Christopher Anderson, University of Wisconsin—Madison

## Undergraduate Student Mentorship

- 2014 – 2015 Alexander Roman, Carnegie Mellon University
- 2013 – 2014 Ze Fu, University of British Columbia

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## Contributed Public Software

- 2014 – present Bitshuffle, Primary author  
<https://github.com/kiyo-masui/bitshuffle>  
<https://pypi.python.org/pypi/bitshuffle>
- 2014 – present Burst Search, Maintainer and contributor  
[https://github.com/kiyo-masui/burst\\_search](https://github.com/kiyo-masui/burst_search)
- 2013 – present Cluster Astronomical Python Utilities, Maintainer and contributor  
<https://github.com/radioc cosmology/caput>

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## Grants and Allocations

### Telescope allocations

- 2017 High Sensitivity Array, “Scintillation of FRB121102 and the associated persistent radio source”, Co-Investigator, 50 hours
- 2017 Green Bank Telescope, “Follow-up of one candidate 21 cm absorber found by blind searching”, Co-Investigator, 12 hours
- 2015 Green Bank Telescope, “Follow-up of two candidate 21 cm absorbers found by blind searching”, Co-Investigator, 8 hours
- 2014 Green Bank Telescope, “Redshift space distortions with 21 cm intensity mapping in cross-correlation” (continuation), Co-Investigator, 500 hours
- 2014 Parkes Observatory, “HI intensity mapping: Parkes-2dFGRS and BAO science”, Co-Investigator, 70 hours

- 2013 Green Bank Telescope, “Redshift space distortions with 21 cm intensity mapping in cross-correlation”, Co-Investigator, 134 hours
- 2012 Green Bank Telescope, “21 cm intensity mapping with prototype receiver”, Co-Investigator, 10 hours
- 2012 Green Bank Telescope, “Baryon acoustic oscillations with 21 cm intensity mapping”, Co-Investigator, 100 hours
- 2011 Green Bank Telescope, “21 cm intensity mapping”, Co-Investigator, 100 hours plus student support
- 2010 Green Bank Telescope, “Study of velocity distortions using 21 cm intensity mapping”, Co-Investigator, 300 hours plus student support

### **Research Grants**

- 2019 NEC Corporation Fund for Research in Computers and Communication, “Radio Data Records for Precise Localization of a Hundred Fast Radio Burst”, Principal Investigator, \$75 000 USD
- 2014 Canadian Institute for Advanced Research Global Scholar Creativity Fund, “Using the stars to test quantum mechanics”, Co-Investigator, \$5000 CAD for meeting support

## --- **Academic Service**

### **Reports**

- 2014 – 2017 Cosmology and Gravity Program Meeting Report, Coauthor, Canadian Institute for Advanced Research (four annual reports)

### **Events**

- 2019 Science at Low Frequencies VI, Scientific Organizing Committee, Tempe, Dec. 2019
- 2017 GBT Intensity Mapping Analysis Workshop, Organizer, Toronto, Oct. 2017
- 2012 GBT Intensity Mapping Analysis Workshop, Organizer, Toronto, May. 2012
- 2011 21-cm Cosmology: Advanced Data Analysis Workshop, Organizer, Toronto, June. 2011

### **Peer Review**

Nature, Nature Astronomy, Physical Review Letters, Physical Review D, Astrophysical Journal, Monthly Notices of the Royal Astronomical Society, and Astronomy and Computing

## --- **Research Presentations**

### **Seminars and Colloquia**

- 2019 Tech Talk, Dominion Radio Astrophysical Observatory, Penticton, July 2019.
- 2019 Astrophysics Seminar, Brown University, Providence, Apr. 2019.
- 2018 Astrophysics Seminar, Massachusetts Institute of Technology, Cambridge, Jan. 2018.
- 2018 Physical Sciences Seminar, University of Washington Bothell, Seattle, Jan. 2018.
- 2017 Physical Sciences Colloquium, University of Washington Bothell, Seattle, Nov. 2017.
- 2017 Seminar, Perimeter Institute for Theoretical Physics, Waterloo, Oct. 2017.
- 2017 Cosmology Seminar, Simon Fraser University, Burnaby, Apr. 2017.

- 2017 Astronomy & Physics Seminar, Saint Mary's University, Halifax, Mar. 2017.
- 2017 Astronomy Seminar, Carnegie Mellon University, Pittsburgh, Mar. 2017.
- 2017 Seminar, Canadian Institute for Theoretical Astrophysics, Toronto, Mar. 2017.
- 2017 Physics and Astronomy Colloquium, University of British Columbia, Vancouver, Jan. 2017.
- 2016 Astronomy Tea Talk, California Institute of Technology, Pasadena, Nov. 2016.
- 2016 Seminar, Perimeter Institute for Theoretical Physics, Waterloo, Jan. 2016.
- 2015 Dark Universe Science Center Seminar, University of Washington, Seattle, Oct. 2015.
- 2014 Seminar, Academia Sinica Institute of Astronomy and Astrophysics, Taipei, Oct. 2014.
- 2012 Cosmology Seminar, University of California, Berkeley, Oct. 2012.
- 2012 Seminar, Australia Telescope National Facility Headquarters, Sydney, Apr. 2012.
- 2012 Astrophysics Seminar, University of Melbourne, Mar. 2012.

### **Conferences**

- 2019 Plenary Talk, Canadian Astronomical Society Annual General Meeting, Montreal, June 2019.
- 2018 Canadian Astronomical Society Annual General Meeting, Victoria, May 2018.
- 2017 Plenary Talk, Annual Meeting of the American Physical Society Northwest Section, Forest Grove, June 2017.
- 2017 Canadian Institute for Advanced Research, Program in Cosmology and Gravity, annual meeting, Lake Louise, Mar. 2017.
- 2016 Canadian Institute for Advanced Research, Program in Cosmology and Gravity, annual meeting, Whistler, Mar. 2016.
- 2015 Canadian Institute for Advanced Research, Program in Cosmology and Gravity, annual meeting, Banff, Mar. 2015.
- 2014 Canadian Institute for Advanced Research, Program in Cosmology and Gravity, annual meeting, Quebec City, May 2014.
- 2014 A Workshop Celebrating the Career of John A. Galt, Penticton, Sept. 2014.
- 2013 Canadian Astronomical Society Annual General Meeting, Vancouver, May 2013.
- 2013 Innovative Techniques in 21cm Analysis, Columbus, Apr. 2013.
- 2010 CITA25/Bond60, Toronto, May 2010.

### **Panels**

- 2019 Panelist, Center for Computational Astrophysics Intensity Mapping Workshop, New York, Feb. 2019.

## Outreach and Press

### **Articles**

- 2017 “Research brief: A repeating fast radio burst”, [Canadian Institute for Advanced Research—Ideas Exchange \(2017\)](#).



## Public Lectures

- 2017 TRIUMF Saturday Morning Lecture, Simon Fraser University, Burnaby, Dec. 2017.
- 2017 Cosmic Nights: Science of Science Fiction Lecture, H.R. MacMillan Space Centre, Vancouver, Nov. 2017.
- 2017 TRIUMF Saturday Morning Lecture, TRIUMF, Vancouver, Sept. 2017.
- 2016 Monthly Meeting, Royal Astronomical Society of Canada—Vancouver Centre, Vancouver, Apr. 2016.

## Events

- 2017 University of British Columbia Eclipse Event, Volunteer, University of British Columbia, Department of Physics and Astronomy, Aug. 2017
- 2016 Salal Preschool Departmental Visit, Organizer, University of British Columbia, Department of Physics and Astronomy, Aug. 2016
- 2009 Science Rendezvous, Volunteer, University of Toronto, May 2009

## CHIME Press

- 2019 C. Wood, “CHIME: Mapping the Early Universe”, [Space.com \(2019\)](#).
- 2019 “Revolutionary radio telescope detects bevy of fast radio bursts”, [MIT News \(2019\)](#).
- 2019 D. Coldeway, “Astronomers spot more mysterious radio signals from far outside the galaxy”, [Tech Crunch \(2019\)](#).
- 2017 I. Semeniuk, “Listening for the universe to chime in”, [The Globe and Mail \(2017\)](#).
- 2017 N. Mortillaro, “Canada’s largest radio telescope unveiled in British Columbia”, [Canadian Broadcasting Corporation News \(2017\)](#).

## FRB 110523 Press

- 2016 S. Hall, “The Mystery of Fast Radio Bursts”, *Sky & Telescope* **132**, 24 (2016).
- 2015 E. Gibney, “Mysterious radiowave blast may have come from starquake”, [Nature \(2015\) 10.1038/nature.2015.18935](#).
- 2015 N. Drake, “Those Blasts of Radio Waves from Deep Space? Not Aliens”, [Phenomena, National Geographic \(2015\)](#).
- 2015 L. Billings, “Fast Radio Bursts Mystify Experts—for Now”, [Scientific American \(2015\)](#).
- 2015 “‘Fast Radio Burst’ Sheds New Light on Origin of These Extreme Events”, [National Radio Astronomy Observatory, press release \(2015\)](#).

## Dispersion Space Press

- 2015 D. Lindley, “Focus: Radio Signals May Reveal Cosmological Structure”, *Physics* **8**, 90 (2015).
- 2015 “Researchers propose new way to chart the cosmos in 3D”, [University of British Columbia, press release \(2015\)](#).
- 2015 “The Flash Measure”, [Radio New Zealand National—Nights \(2015\)](#).