

## EMPLOYMENT

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<b>University of Nevada, Las Vegas</b> NCfA Postdoctoral Fellow	Las Vegas, NV 2024–present
<b>Pennsylvania State University</b> Assistant Research Professor Postdoctoral Scholar	University Park, PA 2022–2024 2021–2022

## EDUCATION

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<b>The University of Tokyo</b> Ph.D. in Physics, Advisor: Prof.Kipp Cannon – Thesis title : Modeling and Searching for Stochastic Gravitational-waves Backgrounds from Ultralight Boson Particles	Tokyo, Japan 2018–2021
<b>The University of Tokyo</b> M.S. in Physics, Advisor: Prof.Kipp Cannon – Thesis title : Towards a Search for Stochastic Gravitational-Wave Backgrounds from Ultra-light Bosons	Tokyo, Japan 2016–2018
<b>The University of Tokyo</b> B.S. in Applied Physics, Advisor: Prof.Norikatsu Mio – Thesis title : Performance evaluation of the frequency reference cavity for KAGRA detector	Tokyo, Japan 2011–2016

## RESEARCH EXPERIENCE

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<b>Nevada Center of Astrophysics, University of Nevada, Las Vegas</b> – Optimizing a GW search pipeline, GstLAL, targeted for electromagnetic counterparts. – Incorporation of sub-threshold events into the compact-binary population analysis	Las Vegas, NV 2024–present
<b>Pennsylvania State University</b> – Development of a low-latency gravitational wave (GW) search pipeline, GstLAL – Bayesian parameter estimation for targeted anisotropic GW background	University Park, PA 2021–2024
<b>Research Center for the Early Universe, The University of Tokyo</b> <i>M.S./Ph.D. Research, supervised by Prof.Kipp Cannon</i> – Fast evaluation of trigger consistency between multiple detectors using GstLAL – Searches for ultra-light bosons using stochastic GW background	Tokyo, Japan 2016–2021
<b>LIGO Lab, California Institute of Technology</b> <i>LIGO visitor program, hosted by Prof.Alan Weinstein</i> – Development and event follow-up for online analysis of a GW detection pipeline, GstLAL – Joint study on GW search for the ultra-light boson particle through superradiant instability	Pasadena, CA Summer 2019
<b>Laboratoire d'Annecyde Physique des Particules</b> <i>Visiting research, supervised by Dr.Tania Regimbau</i> – Mock data study for the detection of stochastic GW background from anisotropically distributed compact binary coalescence.	Annecy, France Fall 2018

<b>University of Minnesota</b> <i>Visiting research, supervised by Prof. Vuk Mandic</i>	Minneapolis, MN Spring 2018
– Development of a search pipeline for GW background from ultra-light scalar fields.	
<b>The University of Tokyo</b> <i>B.S. Research, supervised by Prof. Norikatsu Mio</i>	Tokyo, Japan 2015–2016
– Evaluating optical properties and frequency stability of the reference cavity KAGRA.	
<b>LIGO Livingston Observatory, California Institute of Technology</b> <i>LIGO SURF program, supervised by Dr. Valery Frolov</i>	Livingston, LA Summer 2014
– Constructing the theoretical model of the optical loss inside the arm cavities of the Advanced LIGO.	

## TEACHING EXPERIENCE

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• <b>Substitute Lecturer</b> at Pennsylvania State University <i>Electromagnetism</i>	Fall 2022
• <b>Teaching Assistant</b> at The University of Tokyo <i>Analytical mechanics</i>	Fall 2016

## FELLOWSHIP AND AWARDS

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• <b>NCfA Fellowship</b> , University of Nevada Las Vegas	2024
• <b>Paper Award</b> , United Japanese researchers Around the world	2024
• <b>LEADER Fellowship</b> (declined), Japan Society for the Promotion of Science (JSPS)	2023
• <b>Best Poster Award</b> , Gravitational Wave Orchestra	2022
• <b>Best Presentation Award</b> , The 7th KAGRA International Workshop	2020
• <b>DC1 Research Fellowship</b> , JSPS	2018–2021
• <b>LIGO Visitor Program</b> , California Institute of Technology	2019
• <b>Overseas Challenge Program for Young Researchers</b> , JSPS	2019
• <b>GRASP Scholarship</b> , The University of Tokyo	2018
• <b>SURF Program</b> , California Institute of Technology	2014
• <b>Best Project Award</b> , Cosmic/Particle Spring school	2014

## RESEARCH TALKS

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### INVITED TALKS, SEMINARS, PANEL, SYMPOSIUM

<i>Going wider and deeper in the search for gravitational waves</i> CRA seminar, Georgia Institute of Technology	2024 Atlanta, USA
<i>Going wider and deeper in the search for gravitational waves</i> Astrophysics Colloquium, Texas Tech University	2024 Lubbock, USA
<i>Overview and prospect of the GW transient search in the fourth observing run</i> The extreme Universe : CTA-Japan workshop	2024 Tokyo, Japan
<i>Toward unified Bayesian parameter inference of stochastic gravitational wave backgrounds</i> LIGO seminar, California Institute of Technology	2023 Pasadena, USA
<i>The improvement of GstLAL's ranking statistics toward the fourth observing run</i> Utrecht & UMass Dartmouth joint seminar	2023 USA (online)

<i>Overview and future prospect of LIGO-Virgo-KAGRA's fourth observing run</i>	2023
Astronomy Society of Japan Autumn meeting	Nagoya, Japan
<i>Toward unified Bayesian parameter inference of stochastic gravitational wave backgrounds</i>	2023
C-lab seminar, Nagoya University	Nagoya, Japan
<i>Panel for gravitational waves and multi-messenger astronomy</i>	2023
New Evolution of Multi-Messenger Astrophysics, Penn State	State College, USA
<i>Observation of neutron stars during LIGO-Virgo-KAGRA's observing runs</i>	2022
APS April meeting	New York, USA
<i>Modeling and searching for a stochastic GW background from ultralight bosons</i>	2021
GW Physics and Astronomy: Genesis, The Fourth Annual Area Symposium	Japan (online)
<i>Low-latency detection of the GWs from compact binary coalescences</i>	2022
ISAS seminar, ISM astronomy seminar, JGW seminar	Japan
<i>Gravitational waves from neutron star-black hole coalescences</i>	2021
LIGO-Virgo-KAGRA Collaboration webinar	online
<i>First observations of black hole and neutron star mergers</i>	2021
Fundamental Theory Seminar, Penn State	Pennsylvania, USA
<i>First search for stochastic GW backgrounds from ultra-light bosons</i>	2018
The CGCA seminar, University of Wisconsin Milwaukee	Wisconsin, USA
<i>Application of a low-latency whitening filter to CBC GW searches</i>	2016
RESCEU joint seminar, The University of Tokyo	Tokyo, Japan

## SELECTED CONTRIBUTED TALKS

<i>The improvement of GstLAL's ranking statistics toward the fourth observing run</i>	2023
APS April meeting	Minnesota, USA
<i>First observations of black hole and neutron star mergers</i>	2021
The 8th KAGRA International Workshop	Korea (online)
<i>Modeling and searching for a stochastic GW background from ultralight bosons</i>	2021
Amaldi 14	Australia (online)
<i>Stochastic GW backgrounds from ultra-light vectors</i>	2019
The 29th Workshop on General Relativity and Gravitation in Japan	Kobe, Japan
<i>Anisotropic GW background Mock data study</i>	2019
Gravitational Wave Physics and Astronomy Workshop	Tokyo, Japan
<i>A first search for stochastic GW backgrounds from ultra-light scalars</i>	2018
Gravitational Wave Physics and Astronomy Workshop	Maryland, USA
<i>Application of a low-latency whitening filter to CBC GW searches</i>	2017
The Third KAGRA International Workshop	Taipei, Taiwan

## MENTORING EXPERIENCE

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- **Noah Zhang** Ph.D student at Georgia Institute of Technology spring 2024 - present  
*Targeted gravitational-wave search for compact binaries using a GstLAL pipeline*
- **Soichiro Kuwahara** Ph.D student at The University of Tokyo spring 2022 - fall 2024  
*GPU-accelerated parameter estimation for anisotropic gravitational-wave backgrounds*
- **Santiago Jaraba** Ph.D student at Universidad Aut'ónoma de Madrid spring 2022 - spring 2024  
*Parameter estimation for anisotropic gravitational-wave backgrounds [12]*
- **Deepali Agarwal** Ph.D student at IUCAA spring 2022 - 2023  
*Parameter estimation for anisotropic gravitational-wave backgrounds [12]*
- **Erik Floden** Ph.D student at University of Minnesota spring 2021 - fall 2024  
*Parameter estimation and spherical-harmonics searches of anisotropic gravitational-wave backgrounds [12], [15], [28]*
- **Anarya Ray** Ph.D student at University of Wisconsin-Milwaukee spring 2022 - spring 2023  
*Improving background sampling procedure for GstLAL*
- **Richard George** Ph.D student at The University of Texas at Austin spring 2022 - spring 2023  
*Improving SNR –  $\xi^2$  signal model of GstLAL [9]*
- **Andre Guimaraes** Ph.D student at Louisiana State University spring 2022 - spring 2023  
*Improving SNR –  $\xi^2$  signal model of GstLAL [9]*
- **Shio Sakon** Ph.D student at Pennsylvania State University spring 2022  
*Optimization of GstLAL's template bank [3]*
- **Shomik Adhichary** Ph.D student at Pennsylvania State University spring 2022 - present  
*Improving ranking statistics for gravitational-wave detection pipeline, GstLAL [9]*
- **Prathamesh Joshi** Ph.D student at Pennsylvania State University spring 2022 - fall 2024  
*Implementation of contamination removal and bank- $\xi^2$  statistics in GstLAL [8], [9]*
- **Takuya Tsutsui** Ph.D student at The University of Tokyo 2019  
*Rapid localization of gravitational wave sources [19]*

## PROFESSIONAL SERVICE

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- **Co-chair of Gravitational Wave Transient Catalog working group** : LVK Collaboration 2024–present
- **Thesis committee** : Pennsylvania State University 2023
- **Co-leader of anisotropic stochastic-background working group** : LVK Collaboration 2022–present
- **Referee** : Physical Review D, Physical Review Letter 2022–present
- **Advanced LIGO science summaries** : Writer and japanese translator 2021
- **Vice director** : Cosmic/Astrophysics Student Summer School in Japan 2019
- **Workshop Assistant** : Gravitational Wave Physics and Astronomy Workshop 2019

## OUTREACH

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- **KAGRA outreach group** 2020–2021
- **SCJSF&JABA forum talk** 2020
- **Japanese translation of GW190425's science summary** 2019
- **GW education at a public school in Pasadena** 2019
- **RESCEU Open Lab** 2017, 2018
- **International Space Education Board Student Program** 2015, 2016

### SHORT AUTHOR LIST PUBLICATIONS AND PREPRINTS

- [1] S. S. Chaudhary, *et al.* including **L. Tsukada**, “Low-latency gravitational wave alert products and their performance at the time of the fourth ligo-virgo-kagra observing run”, *Proceedings of the National Academy of Sciences*, vol. 121, no. 18, e2316474121, Apr. 2024.
- [2] B. Ewing, R. Huxford, D. Singh, **L. Tsukada**, *et al.*, “Performance of the low-latency gstlal inspiral search towards ligo, virgo, and kagra’s fourth observing run”, *Physical Review D*, vol. 109, no. 4, Feb. 2024.
- [3] S. Sakon, **L. Tsukada**, *et al.*, “Template bank for compact binary mergers in the fourth observing run of advanced ligo, advanced virgo, and kagra”, *Physical Review D*, vol. 109, no. 4, Feb. 2024.
- [4] S. Schmidt, S. Caudill, J. D. E. Creighton, R. Magee, **L. Tsukada**, *et al.*, *Searching for gravitational-wave signals from precessing black hole binaries with the gstlal pipeline*, 2024. arXiv: 2403.17186 [gr-qc].
- [5] S. Morisaki, R. Smith, **L. Tsukada**, S. Sachdev, S. Stevenson, C. Talbot, and A. Zimmerman, “Rapid localization and inference on compact binary coalescences with the advanced ligo-virgo-kagra gravitational-wave detector network”, *Phys. Rev. D*, vol. 108, p. 123 040, 12 Dec. 2023.
- [6] **L. Tsukada**, “Extension of the bayesian searches for anisotropic stochastic gravitational-wave background with nontensorial polarizations”, *Physical Review D*, vol. 108, no. 12, Dec. 2023.
- [7] S. Banagiri, C. P. L. Berry, G. S. C. Davies, **L. Tsukada**, and Z. Doctor, “Unified  $p_{\text{astro}}$  for gravitational waves: Consistently combining information from multiple search pipelines”, *Phys. Rev. D*, vol. 108, p. 083 043, 8 Oct. 2023.
- [8] P. Joshi, **L. Tsukada**, and C. Hanna, “Method for removing signal contamination during significance estimation of a gstlal analysis”, *Phys. Rev. D*, vol. 108, p. 084 032, 8 Oct. 2023.
- [9] **L. Tsukada**, P. Joshi, *et al.*, “Improved ranking statistics of the gstlal inspiral search for compact binary coalescences”, *Physical Review D*, vol. 108, no. 4, Aug. 2023.
- [10] A. Renzini, *et al.* including **L. Tsukada**, “Pygwb: A python-based library for gravitational-wave background searches”, *The Astrophysical Journal*, vol. 952, no. 1, p. 25, Jul. 2023.
- [11] A. Ray, *et al.* including **L. Tsukada**, *When to point your telescopes: Gravitational wave trigger classification for real-time multi-messenger followup observations*, Jun. 2023. arXiv: 2306.07190 [gr-qc].
- [12] **L. Tsukada**, S. Jaraba, D. Agarwal, and E. Floden, “Bayesian parameter estimation for targeted anisotropic gravitational-wave background”, *Physical Review D*, vol. 107, no. 2, Jan. 2023.
- [13] C. Hanna, *et al.* including **L. Tsukada**, “Binary tree approach to template placement for searches for gravitational waves from compact binary mergers”, *Physical Review D*, vol. 108, no. 4, 2023.
- [14] C. Hanna, *et al.* including **L. Tsukada**, “Metric assisted stochastic sampling search for gravitational waves from binary black hole mergers”, *Physical Review D*, vol. 106, no. 8, Oct. 2022.
- [15] E. Floden, V. Mandic, A. Matas, and **L. Tsukada**, “Angular resolution of the search for anisotropic stochastic gravitational-wave background with terrestrial gravitational-wave detectors”, *Physical Review D*, vol. 106, no. 2, Jul. 2022.
- [16] K. Cannon, *et al.* including **L. Tsukada**, “Gstlal: A software framework for gravitational wave discovery”, *SoftwareX*, vol. 14, p. 100 680, Jun. 2021, ISSN: 2352-7110.
- [17] D. Mukherjee, *et al.* including **L. Tsukada**, “Template bank for spinning compact binary mergers in the second observation run of advanced ligo and the first observation run of advanced virgo”, *Physical Review D*, vol. 103, no. 8, Apr. 2021.
- [18] **L. Tsukada**, R. Brito, W. E. East, and N. Siemonsen, “Modeling and searching for a stochastic gravitational-wave background from ultralight vector bosons”, *Phys. Rev. D*, vol. 103, p. 083 005, 8 Apr. 2021.

- [19] T. Tsutsui, K. Cannon, and **L. Tsukada**, “High speed source localization in searches for gravitational waves from compact object collisions”, *Phys. Rev. D*, vol. 103, p. 043011, 4 Feb. 2021.
- [20] S. Sachdev, *et al.* including **L. Tsukada**, “An early-warning system for electromagnetic follow-up of gravitational-wave events”, *The Astrophysical Journal*, vol. 905, no. 2, p. L25, Dec. 2020.
- [21] C. Messick, *et al.* including **L. Tsukada**, *Automating the inclusion of subthreshold signal-to-noise ratios for rapid gravitational-wave localization*, Nov. 2020. arXiv: 2011.02457 [astro-ph.IM].
- [22] P. Godwin, *et al.* including **L. Tsukada**, *Incorporation of statistical data quality information into the gstlal search analysis*, Oct. 2020. arXiv: 2010.15282 [gr-qc].
- [23] C. Chan, *et al.* including **L. Tsukada**, “Improving the background estimation technique in the gstlal inspiral pipeline with the time-reversed template bank”, Sep. 2020. eprint: 2009.03025.
- [24] C. Hanna, S. Caudill, C. Messick, A. Reza, S. Sachdev, **L. Tsukada**, *et al.*, “Fast evaluation of multidetector consistency for real-time gravitational wave searches”, *Physical Review D*, vol. 101, no. 2, Jan. 2020.
- [25] **L. Tsukada**, T. Callister, A. Matas, and P. Meyers, “First search for a stochastic gravitational-wave background from ultralight bosons”, *Physical Review D*, vol. 99, no. 10, May 2019.
- [26] S. Sachdev, *et al.* including **L. Tsukada**, *The gstlal search analysis methods for compact binary mergers in advanced ligo’s second and advanced virgo’s first observing runs*, Jan. 2019. arXiv: 1901.08580 [gr-qc].
- [27] **L. Tsukada**, K. Cannon, C. Hanna, D. Keppel, D. Meacher, and C. Messick, “Application of a zero-latency whitening filter to compact binary coalescence gravitational-wave searches”, *Physical Review D*, vol. 97, no. 10, May 2018.

## COLLABORATION PUBLICATIONS (MAJOR CONTRIBUTION)

- [28] B. P. Abbott, *et al.* including **L. Tsukada**, “Search for anisotropic gravitational-wave backgrounds using data from advanced ligo and advanced virgo’s first three observing runs”, *Phys. Rev. D*, vol. 104, p. 022005, 2 Jul. 2021.
- [29] B. P. Abbott, *et al.* including **L. Tsukada**, “Gwtc-2: Compact binary coalescences observed by ligo and virgo during the first half of the third observing run”, *Physical Review X*, vol. 11, no. 2, Jun. 2021.
- [30] B. P. Abbott, *et al.* including **L. Tsukada**, “Observation of gravitational waves from two neutron star–black hole coalescences”, *The Astrophysical Journal Letters*, vol. 915, no. 1, p. L5, Jun. 2021.