

## EMPLOYMENT

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**Pennsylvania State University**

Assistant research professor

University Park, PA

2022–present

**Pennsylvania State University**

Postdoctoral scholar

University Park, PA

2021–2022

## EDUCATION

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**The University of Tokyo**

Ph.D. in Physics, Advisor: Prof.Kipp Cannon

Tokyo, Japan

2018–2021

**The University of Tokyo**

M.S. in Physics, Advisor: Prof.Kipp Cannon

Tokyo, Japan

2016–2018

**The University of Tokyo**

B.S. in Applied Physics, Advisor: Prof.Norikatsu Mio

Tokyo, Japan

2011–2016

## RESEARCH EXPERIENCE

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**Pennsylvania State University**

University Park, PA

2021–present

- Development of a low-latency gravitational-wave (GW) search pipeline, GstLAL
- Gaussian parameter estimation for targeted anisotropic GW background

**Research Center for the Early Universe, The University of Tokyo**

Tokyo, Japan

*M.S./Ph.D. Research, supervised by Prof.Kipp Cannon*

2016–2021

- Fast evaluation of trigger consistency between multiple detectors using GstLAL
- Searches for ultra-light bosons using stochastic GW background

**LIGO Lab, California Institute of Technology**

Pasadena, CA

*LIGO visitor program, hosted by Prof.Alan Weinstein*

Summer 2019

- 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

**Laboratoire d'Annecyde Physiquesdes Particules**

Annecy, France

*Visiting research, supervised by Dr.Tania Regimbau*

Fall 2018

- Mock data study for the detection of stochastic GW background from anisotropically distributed compact binary coalescence (CBC).

**University of Minnesota**

Minneapolis, MN

*Visiting research, supervised by Prof.Vuk Mandic*

Spring 2018

- Development of a search pipeline for GW background from ultra-light scalar fields.

**The University of Tokyo**

Tokyo, Japan

*B.S. Research, supervised by Prof.Norikatsu Mio*

2015–2016

- Evaluating optical properties and frequency stability of the reference cavity KAGRA.

**LIGO Livingston Observatory, California Institute of Technology**

Livingston, LA

*LIGO SURF program, supervised by Dr.Valery Frolov*

Summer 2014

- Constructing the theoretical model of the optical loss inside the arm cavities of the Advanced LIGO.

## SCHOLARSHIPS AND AWARDS

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- **Best Poster Award**, Gravitational Wave Orchestra 2022
- **Best Presentation Award**, The 7th KAGRA International Workshop 2020
- **Japan Society for the Promotion of Science DC1 fellowship** 2018–2021
- **LIGO Visitor Program**, California Institute of Technology 2019
- **Overseas Challenge Program for Young Researchers**, JSPS 2019
- **GRASP Scholarship**, The University of Tokyo 2018
- **SURF Program**, California Institute of Technology 2014
- **Best Project Award**, Cosmic/Particle Spring school 2014

## RESEARCH TALKS

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### INVITED TALKS, SEMINARS, COLLOQUIA

- Invited** *Observation of neutron stars during LIGO-Virgo-KAGRA's observing runs* 2022  
APS April meeting New York, USA
- Invited** *Modeling and searching for a stochastic GW background from ultralight bosons* 2021  
GW Physics and Astronomy: Genesis, The Fourth Annual Area Symposium Japan (online)
- Seminar** *Low-latency detection of the GWs from compact binary coalescences* 2022  
ISAS seminar Sagami-hara Japan
- Seminar** *Low-latency detection of the GWs from compact binary coalescences* 2022  
ISM astronomy seminar Japan (online)
- Seminar** *Low-latency detection of the GWs from compact binary coalescences* 2022  
JGW seminar Japan (online)
- Seminar** *Gravitational waves from neutron star-black hole coalescences* 2021  
LIGO-Virgo-KAGRA webinar
- Seminar** *First observations of black hole and neutron star mergers* 2021  
Fundamental Theory Seminar, Penn State Pennsylvania, USA
- Seminar** *First search for stochastic GW backgrounds from ultra-light bosons* 2018  
The CGCA seminar, University of Wisconsin Milwaukee Wisconsin, USA
- Seminar** *Application of a low-latency whitening filter to CBC GW searches* 2016  
RESCEU joint seminar, The University of Tokyo Tokyo, Japan

### SELECTED CONTRIBUTED TALKS

- Refereed** *First observations of black hole and neutron star mergers* 2021  
The 8th KAGRA International Workshop Korea (online)
- Refereed** *Modeling and searching for a stochastic GW background from ultralight bosons* 2021  
Amaldi 14 Australia (online)
- Refereed** *Stochastic GW backgrounds from ultra-light vectors* 2019  
The 29th Workshop on General Relativity and Gravitation in Japan Kobe, Japan
- Refereed** *Anisotropic GW background Mock data study* 2019  
Gravitational Wave Physics and Astronomy Workshop Tokyo, Japan

<b>Refereed</b> <i>A first search for stochastic GW backgrounds from ultra-light scalars</i>	2018
Gravitational Wave Physics and Astronomy Workshop	Maryland, USA
<b>Refereed</b> <i>Application of a low-latency whitening filter to CBC GW searches</i>	2017
The Third KAGRA International Workshop	Taipei, Taiwan
<b>Non-Refereed</b> <i>Search for anisotropic GW backgrounds from LIGO and Virgo's O3</i>	2021
Japan Physics Society Meeting	Japan (online)
<b>Non-Refereed</b> <i>Towards a search for stochastic GW backgrounds from ultra-light bosons</i>	2018
Gravitational Wave Physics and Astronomy: Genesis	Chiba, Japan
<b>Non-Refereed</b> <i>Application of a low-latency whitening filter to CBC GW searches</i>	2017
Japan Physics Society Meeting	Tochigi, Japan

## OUTREACH

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

## TEACHING

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

## EXTRACURRICULAR ACTIVITIES AND VOLUNTEER

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• <b>Vice director</b> , Cosmic/Astrophysics Student Summer School in Japan	2019
• <b>Workshop Assistant</b> , Gravitational Wave Physics and Astronomy Workshop	2019

## PUBLICATION LIST

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### PEER-REVIEWED (MAJOR CONTRIBUTION)

- [1] **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, 2018.
- [2] S. Sachdev, S. Caudill, H. Fong, R. K. L. Lo, C. Messick, D. Mukherjee, R. Magee, **L. Tsukada**, K. Blackburn, P. Brady, P. Brockill, K. Cannon, S. J. Chamberlin, D. Chatterjee, J. D. E. Creighton, P. Godwin, A. Gupta, C. Hanna, S. Kapadia, R. N. Lang, T. G. F. Li, D. Meacher, A. Pace, S. Privitera, and L. Sadeghian, “The gstlal search analysis methods for compact binary mergers in advanced ligo’s second and advanced virgo’s first observing runs”, Jan. 2019. eprint: 1901.08580.
- [3] **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, 2019.
- [4] C. Hanna, S. Caudill, C. Messick, A. Reza, S. Sachdev, **L. Tsukada**, K. Cannon, K. Blackburn, J. D. E. Creighton, H. Fong, P. Godwin, S. Kapadia, T. G. F. Li, R. Magee, D. Meacher, D. Mukherjee, A. Pace, S. Privitera, R. K. L. Lo, and L. Wade, “Fast evaluation of multidetector consistency for real-time gravitational wave searches”, *Physical Review D*, vol. 101, no. 2, 2020.
- [5] B. P. Abbott *et al.*, “Observation of gravitational waves from two neutron star–black hole coalescences”, *The Astrophysical Journal Letters*, vol. 915, no. 1, p. L5, Jun. 2021.
- [6] B. P. Abbott *et al.*, “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.
- [7] **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. 083005, 8 Apr. 2021.
- [8] 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.
- [9] 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.
- [10] **L. Tsukada**, S. Jaraba, D. Agarwal, and E. Floden, *Bayesian parameter estimation for targeted anisotropic gravitational-wave background*, 2022. arXiv: 2208.14421 [gr-qc].

### IN PREPARATION

- [11] S. Sakon, **L. Tsukada**, H. Fong, C. Hanna, *et al.*, “Template bank for the compact binary mergers for gstlal in the fourth observing run of advanced ligo, advanced virgo, and kagra”, 2022.

### OTHERS

- [12] B. P. Abbott *et al.*, (LIGO Scientific and Virgo Collaboration), “Gw170814: A three-detector observation of gravitational waves from a binary black hole coalescence”, *Physical Review Letters*, vol. 119, no. 14, 2017.
- [13] B. P. Abbott *et al.*, (LIGO Scientific and Virgo Collaboration), “Gw170817: Observation of gravitational waves from a binary neutron star inspiral”, *Physical Review Letters*, vol. 119, no. 16, 2017.
- [14] B. P. Abbott *et al.*, (LIGO Scientific and Virgo Collaboration), *Gwtc-2: Compact binary coalescences observed by ligo and virgo during the first half of the third observing run*, 2020. arXiv: 2010.14527 [gr-qc].

- [15] K. Cannon, S. Caudill, C. Chan, B. Cousins, J. D. E. Creighton, B. Ewing, H. Fong, P. Godwin, C. Hanna, S. Hooper, R. Huxford, R. Magee, D. Meacher, C. Messick, S. Morisaki, D. Mukherjee, H. Ohta, A. Pace, S. Privitera, I. de Ruiter, S. Sachdev, L. Singer, D. Singh, R. Tapia, and **L. Tsukada**, “Gstlal: A software framework for gravitational wave discovery”, Oct. 2020. eprint: 2010.05082.
- [16] C. Chan, K. Cannon, S. Caudill, H. Fong, P. Godwin, C. Hanna, S. Kapadia, R. Magee, D. Meacher, C. Messick, S. R. Mohite, S. Morisaki, D. Mukherjee, A. Nishizawa, H. Ohta, A. Pace, S. Sachdev, M. Shikauchi, L. Singer, **L. Tsukada**, D. Tsuna, T. Tsutsui, and K. Ueno, *Improving the background estimation technique in the gstlal inspiral pipeline with the time-reversed template bank*, 2020.
- [17] C. Chan, K. Cannon, S. Caudill, H. Fong, P. Godwin, C. Hanna, S. Kapadia, R. Magee, D. Meacher, C. Messick, S. R. Mohite, S. Morisaki, D. Mukherjee, A. Nishizawa, H. Ohta, A. Pace, S. Sachdev, M. Shikauchi, L. Singer, **L. Tsukada**, D. Tsuna, T. Tsutsui, and K. Ueno, “Improving the background estimation technique in the gstlal inspiral pipeline with the time-reversed template bank”, Sep. 2020. eprint: 2009.03025.
- [18] P. Godwin, R. Essick, C. Hanna, K. Cannon, S. Caudill, C. Chan, J. D. E. Creighton, H. Fong, E. Katsavounidis, R. Magee, D. Meacher, C. Messick, S. Morisaki, D. Mukherjee, H. Ohta, A. Pace, I. de Ruiter, S. Sachdev, **L. Tsukada**, T. Tsutsui, K. Ueno, L. Wade, and M. Wade, *Incorporation of statistical data quality information into the gstlal search analysis*, 2020.
- [19] C. Messick, S. Sachdev, K. Cannon, S. Caudill, C. Chan, J. D. E. Creighton, R. Everett, B. Ewing, H. Fong, P. Godwin, C. Hanna, R. Huxford, S. Kapadia, A. K. Y. Li, R. K. L. Lo, R. Magee, D. Meacher, S. R. Mohite, D. Mukherjee, A. Nishizawa, H. Ohta, A. Pace, A. Reza, M. Shikauchi, L. Singer, D. Singh, J. R. SK, **L. Tsukada**, D. Tsuna, T. Tsutsui, K. Ueno, and A. Zimmerman, *Automating the inclusion of subthreshold signal-to-noise ratios for rapid gravitational-wave localization*, 2020.
- [20] S. Sachdev, R. Magee, C. Hanna, K. Cannon, L. Singer, J. R. SK, D. Mukherjee, S. Caudill, C. Chan, J. D. E. Creighton, B. Ewing, H. Fong, P. Godwin, R. Huxford, S. Kapadia, A. K. Y. Li, R. K. L. Lo, D. Meacher, C. Messick, S. R. Mohite, A. Nishizawa, H. Ohta, A. Pace, A. Reza, B. S. Sathyaprakash, M. Shikauchi, D. Singh, **L. Tsukada**, D. Tsuna, T. Tsutsui, and K. Ueno, “An early-warning system for electromagnetic follow-up of gravitational-wave events”, *The Astrophysical Journal*, vol. 905, no. 2, p. L25, Dec. 2020.
- [21] D. Mukherjee, S. Caudill, R. Magee, C. Messick, S. Privitera, S. Sachdev, K. Blackburn, P. Brady, P. Brockill, K. Cannon, S. J. Chamberlin, D. Chatterjee, J. D. Creighton, H. Fong, P. Godwin, C. Hanna, S. Kapadia, R. N. Lang, T. G. Li, R. K. Lo, D. Meacher, A. Pace, L. Sadeghian, **L. Tsukada**, L. Wade, M. Wade, A. Weinstein, and L. Xiao, “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, 2021.
- [22] C. Hanna, P. Joshi, R. Huxford, K. Cannon, S. Caudill, C. Chan, B. Cousins, J. D. E. Creighton, B. Ewing, M. Fernandez, H. Fong, P. Godwin, R. Magee, D. Meacher, C. Messick, S. Morisaki, D. Mukherjee, H. Ohta, A. Pace, S. Privitera, S. Sachdev, S. Sakon, D. Singh, R. Tapia, **L. Tsukada**, D. Tsuna, T. Tsutsui, K. Ueno, A. Viets, L. Wade, M. Wade, and J. Wang, “Metric assisted stochastic sampling search for gravitational waves from binary black hole mergers”, *Physical Review D*, vol. 106, no. 8, 2022.
- [23] C. Hanna, J. Kennington, S. Sakon, S. Privitera, M. Fernandez, J. Wang, C. Messick, A. Pace, K. Cannon, P. Joshi, R. Huxford, S. Caudill, C. Chan, B. Cousins, J. D. E. Creighton, B. Ewing, H. Fong, P. Godwin, R. Magee, D. Meacher, S. Morisaki, D. Mukherjee, H. Ohta, S. Sachdev, D. Singh, R. Tapia, **L. Tsukada**, D. Tsuna, T. Tsutsui, K. Ueno, A. Viets, L. Wade, and M. Wade, *A binary tree approach to template placement for searches for gravitational waves from compact binary mergers*, 2022.