# Takumi Matsuzawa

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## Education

**The University of Chicago**, Chicago, IL 2016-
*Ph.D. candidate*, Physics

**The University of Chicago**, Chicago, IL 2016-17
*Master of Science*, Physics

**Kalamazoo College**, Kalamazoo, MI 2013-16
*Bachelor of Arts*, Physics with honors and Chemistry, *summa cum laude*.

## Research Experience

**Turbulence through Vortex Ring Collision**, University of Chicago 2017-
- Engineered an innovative data acquisition system involving multiple high-speed cameras and a pulsed laser for volumetric analyses of complex fluid phenomena such as turbulence (Funded by Army Research Office over $500k)
- Created a data pipeline to process TB of raw image data into a few GB for statistical analyses, reducing the processing time from several days to a few hours
- Built a Python library (>20k lines) to analyze 3D/4D flow single-handedly
- Developed an optical flow estimator for particle image velocimetry using a CNN
- Mentored several graduate and undergraduate students for experimental and computational projects including machine-learning vortex dynamics and 4D data visualization

**Splashing of Low Viscosity Fluids**, University of Chicago 2016-17
- Examined the mechanism of splashing in the low-viscosity limit using a high-speed videography

**Targeting Studies for Mu2e-II**, Fermi National Accelerator Laboratory 2015
- Assessed the merits of the proposed upgrade of the proton beamline for the Mu2e experiment using a particle tracking simulator called G4beamline. See the report here.

**Phase Transition Simulation of Yukawa System**, Kalamazoo College 2014-16
- Investigated a solid-liquid phase transition of the Yukawa system through a molecular dynamics simulator (LAMMPS), and a Monte Carlo simulation, supervised by Professor Jan Tobochnik

**Modeling Altered Synaptic Plasticity**, Kalamazoo College 2014-16
- Constructed a mathematical model of the altered synaptic plasticity of Alzheimer's patients which could explain memory loss and disabilities to learn

**Laser Break-Down Spectroscopy**, KEK 2014
- Conducted laser break-down spectroscopy to evaluate mechanical properties of alloys

**A Guide to the Vaccination Debate** 2014
- Led an interdisciplinary study on effectiveness of vaccines to bridge parents and public health offices. See the report here

## Skills

**Programming**: Python(experienced), MATLAB(experienced), Java(intermediate), C(intermediate), C++ (limited experience), OpenGL(intermediate), HTML(experienced), CSS(experienced)
**Computer**: Mathematica, Root, LabView, LAMMPS, Houdini, Blender LaTeX, git
**Fluid Dynamics**: 2D particle image velocimetry, 2D/3D particle tracking velocimetry, superfluid simulation using Gross-Pitaevskii equation
**Language**: English (proficient), Japanese (native) and German (conversational)
**Other**: CAD, 3D printing, laser cutting, machining, laser tomography

**Teaching Experience**

**Teaching Assistant**, The University of Chicago
Winter 2019: Experimental Physics (PHYS 211)
Fall 2018: Computational Physics with Python (PHYS 250)
Spring 2018: Introductory Physics: Waves, Optics, and Heat for Honors (PHYS 143)
Spring 2017: Introductory Physics: Waves, Optics, and Heat (PHYS 133)
Winter 2017: Introductory Physics: Electricity and Magnetism (PHYS 132)
Fall 2016: Introductory Physics: Mechanics (PHYS 131)

**Teaching Assistant**, Kalamazoo College
Spring 2016:Thermal Physics (PHYS 360)
Fall 2016: Quantum Mechanics (PHYS 420)
Fall 2016: Astrophysics (PHYS 480)
Fall 2014: Modern Physics (PHYS 220)
Spring 2014: Introductory Physics (PHYS 152)
Winter 2014: Introductory Physics (PHYS 150)

**Peer Consultant**, Kalamazoo College 2014-16
Tutored the undergraduate level math and physics at the Math-Physics Center

**Publications**

**Matsuzawa T**, Zalányi L, Kiss T. and Érdi P, Multi-scale modeling of altered synaptic plasticity related to Amyloid $\beta$ effects, Neural Networks, 2017.

Érdi P, **Matsuzawa T**, John T, Kiss T and Zalányi L.: Connecting Epilepsy and Alzheimers Disease: Modeling of Normal and Pathological Rhythmicity and Synaptic Plasticity Related to Amyloid $\beta$ Effects. In: Érdi P, Bhattacharya BS and Cochran Al (Eds.): Computational Neurology and Psychiatry (Springer Series in Bio-/Neuroinformatics) 1st ed. 2017 Edition, pp 93-119.

**In review**

**Matsuzawa T**, Mitchell N, Perrard S, and Irvine W. Creation of an isolated turbulent blob fed by vortex rings

**In Preparation**

**Matsuzawa T** and Irvine W., Free decay of an isolated turbulent blob

**Awards and Scholarships**

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| Grainger Foundation Fellowship for Outstanding Research in Physics | 2022 |
| Research & Personal Development Fund | 2021 |
| Sidney Nagel Prize for Creativity in Research | 2020 |
| University Graduate Fellowship | 2016-2021 |
| John Wesley Hornbeck Prize for Excellence in Physics | 2016 |
| Senior Leadership Recognition Award for Excellence in Teaching Physics | 2016 |
| The 39th Lower Michigan Mathematics Competition, 2nd Place | 2015 |
| Lee Teng Undergraduate Fellowship in Accelerator Science and Engineering | 2015 |
| Anne W. S. Scholarship for the Sciences | 2014-16 |
| J. Ward and Mary Greiner Grant | 2014 |
| The ACSJL Interdisciplinary Research Grant | 2014 |
| Dean's List, Kalamazoo College | 2013-16 |
| The 36th Professor Harry Messel International Science School - One of the eight winners of the Prime Minister scholarship | 2011 |

**Grant writing (assist)**

Army Research Office 2021, DURIP, Annual report
Army Research Office 2020, DURIP

Army Research Office 2020, DURIP, Annual report
Army Research Office 2019, DURIP

**Talks and Presentations**

American Physical Society March Meeting, *Talk* Mar. 2022
"Creation of an Isolated Turbulent Blob Sustained by Vortex Ring Injection"
"From vortex reconnections to turbulence"
The University of Chicago, Soft Matter Friday Seminar, *Talk* Apr. 2022
American Physical Society March Meeting, *Talk* Mar. 2021
"Creation of an Isolated Turbulent Blob Sustained by Vortex Ring Injection"
American Physical Society, Division of Fluid Dynamics, *Talk* Oct. 2020
"Realization of Confined Turbulence Through Multiple Vortex Ring Collision"
Simons Foundation, Turbulence Across Vast Scales, *Poster* Dec. 2019
"Turbulence through Vortex Ring Collisions"
The University of Chicago, Soft Matter Bag Lunch, *Talk* Sep. 2019
"How does nature cook and eat up a turbulent puff?"
American Physical Society March Meeting, *Talk* Mar. 2019
"Realization of Confined Turbulence Through Multiple Vortex Ring Collision"
Japanese Researchers Crossing in Chicago, Consulate of Japan, *Talk* Oct. 2018
"Topology in Fluids"
The University of Chicago, Soft Matter Bag Lunch, *Talk* Oct. 2017
"Confinement of Turbulence in Experimental Settings"
The University of Chicago, Experimental Physics Project, *Poster* May 2017
"Characterization of Thin-Sheet Ejection Using Low-Viscosity Fluids"
Kalamazoo College, Conference for Complex Systems, *Invited Talk* May 2017
"Multi-Scale Modeling of Altered Synaptic Plasticity Related to Amyloid-Beta Effects"
Kalamazoo College, *Talk and Poster* Apr. 2016
"Targeting Studies of the Second-Generation Mu2e Experiment"
Fermi National Accelerator Laboratory, *Talk and Poster* Aug. 2015
"Targeting Studies of the Second-Generation Mu2e Experiment"
Annual Meeting of Society for Neuroscience, Chicago *Poster* Oct. 2015
"Modeling Altered Synaptic Plasticity due to Amyloid-Beta"
KEK, Summer School, *Talk and Poster* Aug. 2014
"Laser Break-Down Spectroscopy on Alloys"

**Community Service**

**Special education teacher** 2021-
Provide educational aid every week for a 9 year-old child with autistic spectral disorder.
**Kagakusha Network, writer** 2019-
Contribute articles and edit submitted manuscripts for Kagakusha Network that is founded to cultivate scientists and engineers of the next generation who can play an active role on the international stage.
**SMART Science Outreach Program** Jul 2022
Provided scientific demonstrations about fluid mechanics to selected high school students to empower them to pursue a career in science
**Research Experience for Undergraduates, mentor** 2020
Supervised an undergraduate to visualize the decay of turbulence through motion of 100k particles.
**Science Outreach**
"Physics With A Bang", The University of Chicago Dec 2018, Dec 2019
"Science Meets Art", Marwen Art School, June 2017
Science demonstrations, Woodward School for Technology and Research 2015
Science demonstrations, Maple Street Magnet School for the Arts 2013-14
**War Memories, Oral History in Liberal Arts** 2015-16
"War Memories explores memories of World War II by Japanese-speaking people who

lived in the Japanese Empire during the war." The project is guided by Noriko Sugimori at Kalamazoo College. I translated several interviews into English, adding Japanese and English subtitles to the videos. They can be found here

**TEDxKalamazooCollege, speaker** 2016

**Society of Physics Students**, Head of Kalamazoo College Chapter 2015-16

**Mentoring Underrepresented Students in Sciences, mentor** 2015-16

Organized a support group at Kalamazoo College, and communicated with the Department heads to enhance academic and mental support for underrepresented students in science.

**Mentoring**

Natherniel Selub, an undergraduate at The University of Chicago 2022-

Tabin Dharanikota, an undergraduate at The University of Chicago 2021

Diego Padilla Monroy, an undergraduate at Florida International University (Summer REU 2020)