

# Yurina Nakazato

## Curriculum Vitae (last updated July 2024)

**Address:** University of Tokyo 7-3-1, Hongo, Bunkyo, 113-0033, Tokyo, Japan  
**Email:** yurina.nakazato@phys.s.u-tokyo.ac.jp  
**Web:** <https://yurinanakazato.github.io>

### Research Interests

First stars, Stream Velocity, first galaxies, cosmic reionization, galaxy formation & evolution, cosmological simulations

### Education

Apr. 2023 - present      **Ph.D. student, The University of Tokyo, Japan**  
Apr. 2021 - Mar. 2023      M.S. in Physics, The University of Tokyo, Japan  
Thesis: *Formation and evolution of star clusters and galaxies in the early Universe*  
Advisor: Naoki Yoshida  
Apr. 2017 - Mar. 2021      B.S. in Physics, The University of Tokyo, Japan

### Fellowships and Awards

Feb. 2024      Outstanding Poster Award at the International Symposium on Quantum Electronics 2024  
Apr. 2023- Mar. 2026      JSR fellowship  
Apr. 2023- Mar. 2026      Japan Society for Promotion of Science (JSPS) Research Fellow, DC1  
Mar. 2023      The School of Science Encouragement Award  
Mar. 2023      The University of Tokyo President's Award  
Mar. 2023      The Excellence Award for Qualifying Exam  
Oct. 2021- present      The International Graduate Program for Excellence in Earth-Space Science (IGPEES), the University of Tokyo  
Aug. 2021      Best Oral Presentation Award at 51th astronomical meeting for junior researchers

### Grants

Apr. 2023-Mar.2026      Evolution of first galaxies with multi-wavelength observations and numerical simulations, 4.2M JPY (30K USD), JSPS Grant-in-Aid for Early-Career Scientists, No. 23KJ0728  
Apr. 2023-Mar.2026      Grand Aid from JSR fellowship, 3M JPY (21K USD), (declined)

### Publications

#### First Author

4. **Y. Nakazato**, D. Ceverino, N. Yoshida, *A merger-driven scenario for clumpy galaxy formation in the epoch of reionization: Physical properties of clumps in the FirstLight simulation*, 2024, arXiv:2402.08911

3. **Y. Nakazato**, N. Yoshida, D. Ceverino, *Simulations of high-redshift [OIII] emitters: Chemical evolution and multi-line diagnostics*, 2023, The Astrophysical Journal, 953, 14, 2023
2. **Y. Nakazato**, G. Chiaki, N. Yoshida, et al., *The formation of Supersonically Induced Gas Objects (SIGOs) with  $H_2$  cooling*, Proceedings of International Astronomical Union, Volume 362, 2023
1. **Y. Nakazato**, G. Chiaki, N. Yoshida, et al.,  *$H_2$  cooling and gravitational collapse of supersonically Induced gas objects*, The Astrophysical Journal Letters, 927, 1, 2022

#### Co-Author

10. Y. Harikane, A. K. Inoue, E. Richard, M. Ouchi, **Y. Nakazato**, N. Yoshida et al., *JWST, ALMA, and Keck Spectroscopic Constraints on the UV Luminosity Functions at  $z = 7-14$ : Clumpiness and Compactness of the Brightest Galaxies in the Early Universe*, 2024, arXiv:2406.18352
9. D. Ceverino, **Y. Nakazato**, N. Yoshida, R.S. Klessen, S.C.O. Glover, *Redshift-dependent galaxy formation efficiency at  $z = 5-13$  in the FirstLight Simulations*, 2024, arXiv:2404.02537, accepted to A&A
8. Y. Sugahara, et al. (incl.**Y. Nakazato**) *RIOJA. Complex Dusty Starburst in a Major Merger B14-65666 at  $z = 7.15$* , 2024, arXiv:2403.17133
7. C. Williams, et al. (incl.**Y. Nakazato**), *The Supersonic Project: Lighting up the faint end of the JWST UV luminosity function*, The Astrophysical Journal Letters 960, 2, 16, 2024
6. D. Tsuna, **Y. Nakazato**, T. Hartwig, *A Photon Burst Clears the Earliest Dusty Galaxies: Modeling Dust in High-redshift Galaxies from ALMA to JWST*, Monthly Notices of the Royal Astronomical Society, 526, 4, 2023
5. W. Lake et al.(incl.**Y. Nakazato**), *The Supersonic Project: Star Formation in Early Star Clusters without Dark Matter*, The Astrophysical Journal Letters 956, 1, 2023
4. T. Hashimoto et al.(incl.**Y. Nakazato**), *Reionization and the ISM/Stellar Origins with JWST and ALMA (RIOJA):The core of the highest redshift galaxy overdensity at  $z = 7.88$  confirmed by NIRSpec/JWST*, The Astrophysical Journal Letters, 955, 8, 2023
3. R. Ura, et al.(incl.**Y. Nakazato**), *Detections of [CII]  $158\ \mu\text{m}$  and [OIII]  $88\ \mu\text{m}$  in a Local Lyman Continuum Emitter, Mrk 54, and Its Implications to High-redshift ALMA Studies*, The Astrophysical Journal, 948, 1, 2023
2. C. Williams, et al.(incl.**Y. Nakazato**), *The Supersonic Project: The eccentricity and rotational support of SIGOs and DM GHOSTs*, The Astrophysical Journal, 945, 1, 2023
1. W. Lake, et al.(incl.**Y. Nakazato**), *The Supersonic Project: The Early Evolutionary Path of SIGOs*, The Astrophysical Journal, 943, 2, 2023

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### Talks at Conferences and Workshops

#### International conferences

12. *A merger-driven scenario for clumpy galaxy formation in the epoch of reionization: Physical properties of clumps in the FirstLight simulation*, IAUS391, Cape Town, South Africa

11. *FirstLight zoom-in simulations: Formation mechanism of [OIII]-bright clumps in high-redshift galaxies from  $z = 6 - 9$* , European Astronomical Society Annual meeting 2024, Padova, Italy
10. *Formation and evolution of galaxies in the early Universe by 3D hydrodynamical simulation*, poster, The International Symposium on Quantum Electronics 2024, The University of Tokyo, Japan
9. *FirstLight simulations: Chemical evolution and bursty star formation history of high-redshift [OIII] emitters*, Resolving the Extragalactic Universe with ALMA & JWST, Waseda Univ., Japan
8. *Simulations of high-redshift [OIII] emitters: Chemical evolution and bursty star formation history*, RESCEU summer School 2023, Nagano Univ., Japan
7. *Simulations of high-redshift [OIII] emitters: Chemical evolution and multi-line diagnostics*, Shedding new light on the first billion years of the Universe, Marseille, France
6. *The formation of star clusters in the early universe through supersonic gas streams*, The 9th East Asian Numerical Astrophysics Meeting (EANAM9), Okinawa, Japan
5. *Effect of streaming motion of baryons relative to dark matter and the formation of star clusters*, Star Formation in Different Environments (SFDE) 2022, Quy Nhon, Vietnam
4. *[OIII] emission lines from high- $z$  galaxies in the Epoch of Reionization*, RESCEU Summer School 2022, online
3. *The formation of gas-rich structure through baryon-dark matter streaming motion*, National Astronomy Meeting (NAM) 2022, online
2. *The formation of gas-rich structure through baryon-dark matter streaming motion*, IAU Symposium 362 The predictive power of computational astrophysics as a discovery tool, online
1. *The formation of Supersonically Induced Gas Objects (SIGOs)*, RESCEU Summer School 2021, online

#### **Domestic conferences**

11. *Formation of clumpy galaxies during the Epoch of Reionization in zoom-in simulations*, ASJ (The Astronomical Society of Japan) Autumn Annual Meeting 2023, Nagoya University, Aichi
10. *Zoom-in simulations of high-redshift galaxies & emission line modeling for JWST and ALMA*, Fine-structure lines workshop 2023, Ehime University, Ehime
9. *Emission line calculation of high-redshift galaxies for JWST & ALMA observation*, Astrophysics Workshop for Young Researchers, The University of Tokyo, Tokyo
8. *[OIII] emission line calculation and line diagnostics from high-redshift galaxy simulations*, ASJ (The Astronomical Society of Japan) Spring Meeting 2023, Rikkyo University, Tokyo
7. *[OIII] observations by ALMA and JWST and high- $z$  galaxy evolution via simulations*, First Stars First Galaxies 2022, Tokushima University, Tokushima
6. *[OIII] emission line ratio in high- $z$  galaxies*, IGM galaxy work shop 2022, Kushiro, Hokkaido
5. *Statistical features of gas dominant objects(SIGOs) in the early universe*, ASJ (The Astronomical Society of Japan) Spring Annual Meeting 2022, online

4. *The formation of Supersonically Induced Gas Objects by Stream Velocity*, First Stars and First Galaxies Symposium 2021, Tokyo
3. *DM deficient cluster formation by stream gas motion relative to dark matter*, ASJ (The Astronomical Society of Japan) Autumn Annual Meeting 2021, online
2. *The formation of Supersonically Induced Gas Objects (SIGOs) with H<sub>2</sub> chemistry*, Symposium for Metal Poor Universe 2021, online
1. *Supersonically Induced Gas Objects via relative velocities between baryon and dark matter*, 51th astronomical meeting for young researchers 2021, online

#### Seminars

7. *Galaxy formation and evolution in the early universe using numerical simulations*, seminar talk, JSR corporation, Online
6. *Physical properties and Inner structures of high-redshift galaxies ( $z > 6$ ) using zoom-in simulations*, seminar talk, Scuola Normale Superiore, Italy
5. *Chemical and dynamical evolution of high-redshift [OIII] emitters in FirstLight simulation*, seminar talk, Universidad Autónoma de Madrid
4. *Chemical evolution and bursty star formation history of high-redshift galaxies from ALMA to JWST*, seminar talk, Centro de Astrobiología, (CAB, CSIC-INTA), Madrid
3. *Modeling of Optical emission lines and recent JWST observations*, One-day workshop on galaxies in the era of JWST/ALMA, Aug. 2023, The University of Tokyo
2. *H<sub>2</sub> cooling of gravitational collapse of SIGOs with high-resolution simulations*, Supersonic Project: Collaboration meeting, UCLA, US
1. *Formation and evolution of star clusters and galaxies in the early Universe*, seminar talk, Feb. 2023, UCLA

### Coverage in Media

**Hunting Faint Galaxies with JWST as a Test for the Dark Matter Model** based on Williams et al. 2024

- *Bright galaxies put dark matter to the test*, UCLA

**The core of the most distant galaxy protocluster observed by JWST & ALMA** based on Hashimoto et al. 2023

- *The Strong Tag Team of the James Webb Space Telescope and ALMA Captures the Core of the Most Distant Galaxy Protocluster*, Kavli IPMU, Tsukuba Univ., Waseda Univ., Nagoya Univ.

### Teaching, Advising, & Professional Service

#### Teaching

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|---------------------|---|
| Apr. 2021-Aug. 2021 | Teaching Assistant, Fluid Mechanics, the University of Tokyo      |
| Apr. 2019- present  | Language Assistant, International Lounge, the University of Tokyo |

#### Advising

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| Nov. 2022- Feb. 2023 | Mitsutaka Usui, Tsukuba University BS astronomy student |
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#### Professional Service

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| Aug. 2023 | Organizer, The 53rd Summer School on Astronomy and Astrophysics, The University of Tokyo, Tokyo, Japan |
| Mar. 2023 | Workshop Organizer, Astrophysics Workshop for Young Researchers, The University of Tokyo, Tokyo, Japan |

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## Proposals

### co-Investigator on ALMA proposals

3. *[CII] 158um emission line and dust observation of the most distant known overdensity of galaxies at  $z = 7.88$*  (PI: Y.Fudamoto); Cycle 10
2. *The ALMA-JWST synergy: [OIII]88um and [CII]158um emission line observations of  $z = 9.51$  galaxy identified by JWST* (PI: Y.Fudamoto); Cycle 10
1. *Pandora's ELPIS: The Emission-Line Protocluster Imaging Survey of the furthest overdensity beyond Pandora's Cluster* (PI: Y.Tamura); Cycle 10

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## Leadership & Outreach

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| Jun. 2023 | Organizer of Get-Together Event for Women in STEM, the University of Tokyo |
| Jul. 2022 | Public Talk at Women in STEM, School of Science, the University of Tokyo   |
| Dec. 2019 | Rikejo Initiative, the University of Tokyo                                 |
| Oct. 2019 | Invited talk at Dow Chemical Company, Tokyo, Japan                         |

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## Research & industry experience

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| Apr. 2024 - Jul. 2024 | <b>Visiting Student at Scuola Normale Superiore di Pisa</b><br>- Host researcher is Prof. Andrea Ferrara.   |
| Nov. 2023 - Dec. 2023 | <b>Visiting Student at Universidad Autónoma de Madrid</b><br>- Host researcher is Dr. Daniel Ceverino.<br>- Worked on formation and evolution of clumpy galaxies by using FirstLight simulation   |
| Feb. 2023 - Mar. 2023 | <b>Visiting Student at UCLA</b><br>- Host researcher is Prof. Smadar Naoz.<br>- Worked on Supersonic Project <a href="#">[link]</a>   |
| Jun. 2020 - Mar. 2021 | <b>Study and Visit Abroad Program</b><br>- Funded by the faculty of science, the University of Tokyo<br>- Online research internship at Naoz lab, UCLA  |
| Dec. 2019 - Jan. 2020 | <b>Online Language Exchange Program - Utokyo &amp; TUM-</b><br>- Participated in an online international exchange program with students from Technical University of Munich   |
| Jun. 2019 - Sep. 2019 | <b>UTokyo Global Internship Program</b><br>- Funded by DAIKIN, a company leading air conditioning and refrigeration.<br>- Two-month workplace training at DAIKIN Japan and two-week research internship at DAIKIN Europe in Belgium. Business proposal for food loss and integrated solution of air conditioning and refrigeration. |
| Aug. 2019             | <b>Summer School of Particle Physics and Nuclear Physics</b><br>- Funded by the High Energy Accelerator Research Organization.  |

- Experiment of measuring muon decay time and observing Lamor Precession and Single-Spin Asymmetries. Made the final presentation and poster session.
- Aug. 2019      **Nanotechnology Platform Student Training Program**
- Funded by National Institute for Materials Science.
  - Five-day research program at Spring-8, the world's largest third-generation synchrotron radiation facility. Conducted X-ray photoelectron spectroscopy (XPS) experiments and data analysis. Made a presentation at the University of Tokyo in September.
- Feb. 2019- Mar. 2019      **Undergraduate Research Assistant, TOMODACHI STEM Program**
- Funded by U.S.-Japan Council.
  - Five-week science & engineering research internship at Gerts lab, Rice University, Houston. Researched and analyzed the heavy iron collision data of STAR experiment conducted at BNL.
  - Final week study tour to Washington, DC including site visits to the Society for the Promotion of Science, JAXA, U.S.-Japan Council, and Women in STEM Workshop at Lehigh University.
- Jul. 2014- Aug. 2014      **Okinawa Global Leaders Program**
- Funded by Okinawa Prefectural Board of Education.
  - Three-week program to introduce students to key concepts in intercultural communication and global leadership.