OSASE OMORUYI

Center for Astrophysics | Harvard & Smithsonian
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Education

Ph.D., Harvard University in Astronomy and Astrophysics 2020-25
Thesis: The Multiphase and Multiscale Impact of Stellar and AGN Feedback on Galaxy Evolution
Committee: Grant Tremblay (Advisor), Karin Öberg, Peter Galison, Lars Hernquist, Douglas Finkbeiner

M.A., Harvard University in History of Science 2020-23
Thesis: Reclaiming Space: The Labor Behind International Astronomy in South Africa
Advisors: Prof. Peter Galison and Prof. Chakanetsa Mavhunga

B.S., Yale University in Astronomy and Astrophysics 2015-19
Thesis: A Multiwavelength View of Bubbles in the Milky Way
Advisor: Prof. Héctor Arce

Research Interests and Experience

3 first-author papers published and/or under review. See list of publications below and click here for an exhaustive ADS library.

- Aims to assemble the high-resolution, multi-wavelength observations needed to **calibrate the *ad-hoc* treatment of AGN feedback in cosmological simulations** using **direct observations of feedback** in addition to aggregate galaxy properties

- Specializes in high-resolution, multi-wavelength **X-ray, optical, mm, and radio observations** of **stellar and AGN feedback in galaxies and galaxy clusters**, utilizing telescopes such as JWST, ALMA, *Chandra*, LOFAR, and HST

- Proficient in **computational astrophysics**, particularly in bridging the detailed physical outputs from **hydrodynamical simulations** with computationally inexpensive, flexible **semi-analytic models** of galaxy formation and evolution.

- Experience conducting ethnographic and archival research on the **history of astronomy**, examining the roles of race, colonialism, and labor in the development of astronomical observatories in the Global South

- Extensive experience **mentoring** and **teaching** undergraduate and high school students, including leading workshops on data analysis methods and graduate school preparation, with a focus on **supporting underrepresented students in STEM**

Honors & Awards

Harvard Philippe Wamba Summer Research Travel Grant ($\$5,000$) 2024
ALMA Student Observing Support Grant ($\$40,000$) 2023
Derek Bok Distinction in Teaching Certificate (Harvard University) 2023
John C. Hansen & Katherine Vogelheim Research and Travel Fund for Africa ($\$2,000$) 2022
240th AAS Chambliss Honorable Mention 2022
Harvard Graduate Prize Fellowship 2020
National Science Foundation Graduate Research Fellowship 2019
Yale Astronomy George Beckwith Prize ($\$1,000$) 2019
Yale College Edward Bouchet Undergraduate Research Fellowship 2017 - 2019
NSF REU Fellowships at Yale University, Caltech and SAO 2016, 2017, 2018

Observing Time Awarded

Atacama Large Millimeter/submillimeter Array *PI, 29.5 hours*
Cycle 9 PID-2023.1.00471.S: A Comprehensive Observational Test of Positive and Negative Black Hole Feedback

Upgraded Giant Metrewave Radio Telescope *PI, 6 hours*
Cycle 46 PID-084: A Multi-Frequency uGMRT Survey of an Extreme AGN Outburst Tied to Young Star Formation

MMT Observatory *PI, 4 hours*
2023A: Resolving the Cooling Flow Problem in SDSS 1531 with a Spectroscopic Survey

JWST *co-I, 8.6 hours*
Cycle 2 PID-4094: A Galaxy-Scale Fountain of Multiphase Gas Pumped by a Black Hole: The power of JWST combined with ALMA, MUSE, Chandra, and HST

***Chandra* X-ray Observatory**
Cycle 26 PID-26700422: Chandra confirmation of a runaway supermassive black hole *Co-I, 300 ks*
Cycle 26 PID-26700420: A hot shell bounding a multiphase, jet-driven outflow in a nearby galaxy *Co-I, 200 ks*

Talks and Presentations

Wellesley Astronomy Colloquium, *Invited Speaker* Nov. 2024

AAS Journal Author Series, *Invited Speaker* Jun. 2024
SAO Harvard Summer Astronomy Colloquium, *Invited Speaker* Jun. 2024
Space Telescope Spring Symposium on Star Formation, *Contributed Poster and Flash Talk* Apr. 2024
Tufts Astronomy Seminar, *Invited Speaker* Mar. 2024
Stockholm University Workshop on Space Science and Care, *Invited Speaker* Sep. 2023
National Society of Black Physicists Conference, *Contributed Talk* Nov. 2022
Historic Observatory Networks Conference, *Invited Speaker* Jun. 2022

Teaching Experience

ASTRON 1: The Big Questions of Astronomy, *Teaching Fellow*, Harvard College Jan. – May. 2023

Select Review from Median 5.0/5.0 Student Evaluation Rating: *"Osase was an amazing TF! One experience that really stands out to me is during one lab, we were observing the Big Dipper [...] Osase went out of her way to help me identify the Big Dipper, using a variety of methods until I was able to see it. I was so impressed by her determination [...] She was also really great at explaining concepts in the class, and helping students arrive at answers to the homework questions without just giving them answers [...] She was also [...] a warm and friendly and approachable TF in general"*

ASTRON 35S: Fundamentals of Astronomy, *Teaching Fellow*, Harvard Summer School Jun. – Aug. 2020

Select Review from Median 5.0/5.0 Student Evaluation Rating: *"Osase always made sure every student in the course understood the course's subjects. She was always both patient and informative, pushing others to do their best."*

EVOLUTIONS After School Program, *Teaching Assistant*, Yale Peabody Museum 2016 - 2019

Select article on work with students: 'Ladies First' exhibit at Peabody spotlights women in STEM

Service

NSF SAO Astronomy REU Program, *REU Director* 2023-24
Harvard Astronomy Student-Faculty Council, *Student Representative* 2022-24
Center for Astrophysics | Harvard & Smithsonian Executive Committee, *Student Representative* 2023-24
Black Hole Initiative Responsible Siting Group, *Member* 2023-24
ALMA Distributed TAC, *Proposal Reviewer* 2022-24
Space Studies Board, National Academies, *Lloyd v. Berkner Space Policy Intern for Astro2020* 2019-20

Science Communication & Outreach

Astrophoto Challenge of Interacting Galaxies, *Invited Subject Matter Expert*, NASA Nov. 2024
Annual Women+ of Color Project Graduate Applications Workshop, *Lead Organizer & Panelist*, Harvard Univ. 2020-23
Intro to Astronomy Research Workshop, *Invited Speaker*, EVOLUTIONS After School Program Jan. 23
Optimizing Code, Python Workshop, *Instructor*, SAO Latino Initiative Program Aug. 22
Getting Great Letters of Recommendation, *Printed Interview*, GradSchoolShopper Magazine Aug. 22

Research Press

Black Hole Fashions Stellar Beads on a String NASA & *Chandra* X-Ray Observatory
200 Millionth Anniversary Gift: A Necklace Made of Stars AAS NOVA
Cosmic 'necklace' of stars may have formed after powerful black hole outburst The Independent
Powerful Jets From a Black Hole are Spawning Star Clusters Universe Today

References

Grant Tremblay, Center for Astrophysics | Harvard & Smithsonian *Graduate Astronomy Thesis Advisor*
grant.tremblay@cfa.harvard.edu

Rachel Somerville, Flatiron Center for Computational Astrophysics *Graduate Research Advisor*
rsomerville@flatironinstitute.org

Matthew Ashby, Center for Astrophysics | Harvard & Smithsonian *Graduate Research & Outreach Collaborator*
mashby@cfa.harvard.edu

Peter Galison, Harvard University *Graduate History of Science Thesis Advisor*
galison@fas.harvard.edu

Héctor Arce, Yale University *Undergraduate Astronomy Thesis Advisor*
hector.arce@yale.edu

Publication List

FIRST AUTHOR PUBLICATIONS

1. **Omoruyi, O.**, Tremblay, G. R., Combes, F., Davis, T. A., Gladders, M. D., Vikhlinin, A., Nulsen, P., Kharb, P., Baum, S. A., O'Dea, C. P., Sharon, K., Terrazas, B. A., Nevin, R., Schechter, A. L., Zuhone, J. A., McDonald, M., Dahle, H., Bayliss, M. B., Connor, T., Florian, M., Rigby, J. R., and Vaddi, S. (**2024a**). **"Beads-on-a-string" Star Formation Tied to One of the Most Powerful Active Galactic Nucleus Outbursts Observed in a Cool-core Galaxy Cluster.** *The Astrophysical Journal*, *963*, 1. doi:10.3847/1538-4357/ad1101

2. **Omoruyi, O.**, Tremblay, G., Vikhlinin, A., Dabhade, P., Raychaudhury, S., Markevitch, M., Zuhone, J., Nulsen, P., Baum, S. A., O'Dea, C. P., Clarke, T., Randall, S., Kharb, P., Gulati, S., and Vaddi, S. **A 600 ks Chandra View of Abell 2597.** *Submitted to ApJ, expected on arXiv early-November **2024b**, PDF available at https://osaseo.github.io/publications/*

3. **Omoruyi, O.**, Terrazas, B., Cohen, Y., Pandya, V., Somerville, R., and Hernquist, L. **Emulating IllustrisTNG with a semi-analytic model.** *Submitted to MNRAS, expected on arXiv early-November **2024c**, PDF available at https://osaseo.github.io/publications/*

4. **Omoruyi, O.**, Tremblay, G., Ashby, M., Baum, S., Blanton, E., Bremer, M., Bulbul, G., Clarke, T., Combes, F., Connor, T., David, L., Davis, T., Donahue, M., Edge, A., Edwards, L., Fabian, A., Forman, W., Gaspari, M., Grace, S., Greene, J., Hamer, S., Jones, C., Kraft, R., Li, Y., McDonald, M., McNamara, B., Nevin, R., Nulsen, P., O'Dea, C., Ogle, P., Oonk, R., Powell, M., Randall, Reefe, M., S., Russell, H., Salome, P., Schechter, A., Simionescu, A., Starikova, S., Su, Y., Sun, M., Terrazas, B., Urry, C., Vantyghem, A., Vikhlinin, A., Voit, M., Wilkes, B., Worku, K., and ZuHone, J. **A JWST MIRI View of the Heart of Abell 2597.** *Expected on arXiv December **2024d**, PDF available at https://osaseo.github.io/publications/*

CONTRIBUTING AUTHOR PUBLICATIONS

1. Singha, M., Winkel, N., Vaddi, S., Perez Torres, M., Gaspari, M., Smirnova-Pinchukova, I., O'Dea, C. P., Combes, F., **Omoruyi, O.**, Rose, T., McElroy, R., Husemann, B., Davis, T. A., Baum, S. A., Lawlor-Forsyth, C., Neumann, J., Tremblay, G. R.. (2023, ApJ). **The Close AGN Reference Survey (CARS): An interplay between radio jets and AGN radiation in the radio-quiet AGN HE 0040-1105**. *The Astrophysical Journal*, 959(2), 107. doi:10.3847/1538-4357/ad004d
   Contribution: My reduction of HST NUV data pinpointed the locations of clumpy gas near the nucleus, providing key evidence that the galaxy is a late-stage merger remnant.

2. Singha, M., Scharwächter, J., Kakkad, D., **Omoruyi, O.**, Rojas, A., Laha, S., Pérez-Torres, M., Combes, F., Sadaula, D. R., Baum, S. A., O'Dea, C. P., Tremblay, G. R., Sebastian, B. **A quenched galaxy at the site of supermassive black hole feedback**. *Submitted to ApJ, expected on arXiv early-November 2024, PDF available at https://osaseo.github.io/publications/*
   Contribution: By reducing and analyzing archival ALMA data, I uncovered a distinct depletion of molecular gas in the path of ionized outflows, suggesting potential AGN-driven quenching.

3. Cohen, Y., Pandya, V., **Omoruyi, O.**, Terrazas, B., Somerville, R., and Hernquist, L. **The Cosmic Baryon Cycle in IllustrisTNG: flows of mass, energy, and metals**. *In preparation. Expected on arXiv by late Fall 2024 - Spring 2025.*
   Contribution: I performed cross-checks on the galaxies comprising the flow sample and primarily analyzed the gas flows in halos dominated by stellar feedback, which informed the creation of the TNG SAM model in Omoruyi+24c.

4. Ogle, P. M., Sebastian, B., Aravindan, A., McDonald, M., Canalizo, G., Perley, R. A., Ashby, M., Azadi, M., Antonucci, R., Barthel, P., Baum, S., Birkinshaw, M., Carilli, C., Chiaberge, M., Duggal, C., Gebhardt, K., Hyman, S., Kuraszkiewicz, J., Lopez-Rodriguez, E., Medling, A., Miley, G., **Omoruyi, O.**, O'Dea, C., Perlman, E., Reynaldi, V., Singha, M., Sparks, W., Tremblay, G., Wilkes, B., Willner, S., and Worrall, D. **The JWST View of Cygnus A: Jet-Driven Outflow with a Twist**. *Submitted, expected on arXiv early November 2024, PDF available at https://osaseo.github.io/publications/*
   Contribution: I provided detailed feedback to enhance the clarity of observational data presentation and interpretation.

5. Elford, J. S., Davis, T. A., Ruffa, I., **Omoruyi, O.**, et. al. **The Close AGN Reference Survey (CARS): A comparison between sub-mm and optical AGN diagnostic diagrams**. *In preparation. Expected on arXiv late Fall 2024.*
   Contribution: I provided detailed feedback to enhance the clarity of observational data presentation and interpretation.

Last Updated: November 8, 2024