

# Martine Lokken

Toronto, ON, Canada • (647) 913-9037 • [m.lokken@mail.utoronto.ca](mailto:m.lokken@mail.utoronto.ca)

## EDUCATION

---

- University of Toronto** Sep. 2018 – Jul. 2023 (expected)  
PhD, David A. Dunlap Department of Astronomy & Astrophysics  
Advisors: Prof. J. Richard Bond and Prof. Renée Hložek
- University of Virginia** Aug. 2014 – May 2018  
BS, Astronomy-Physics, Highest Distinction
- University of Edinburgh** Fall 2016  
Semester Abroad

## RESEARCH PROJECTS

---

- Signals from diffuse warm-hot gas in oriented proto-clusters** 2022-present  
*In collaboration with the ThreeHundred Cluster Project*
- Separating bound from diffuse gas in the ThreeHundred Gizmo-Simba simulations by various methods
  - Analyzing the thermal Sunyaev-Zel'dovich effect from diffuse gas in filaments at  $z=1$
- Sensitivity of anisotropic superclustering to cosmological parameters** 2021-present  
*Advised by Prof. J. Richard Bond and Prof. Renée Hložek, University of Toronto*
- Running non-Lambda CDM cosmologies with the Peak Patch algorithm to rapidly generate halo catalogs and observable maps
  - Assessing the sensitivity of new oriented stacking techniques to cosmological parameters
- Investigating superclustering in cosmic gas** 2018-present  
*Advised by Prof. J. Richard Bond and Prof. Renée Hložek, University of Toronto*
- Developing and testing novel oriented stacking techniques for large scale structure analysis
  - Comparing filamentary structure in the cosmic web between data (ACT tSZ, DES galaxies and galaxy shear) and simulations (Websky, Buzzard)
  - Measuring the anisotropic bias of galaxies and gas pressure in constrained environments
- Simulating supernovae and hosts for the ELAsTiCC Challenge** 2020-2022  
*With Prof. Renée Hložek and the LSST Dark Energy Science Collaboration*
- Used empirically-driven algorithms to simulate supernovae and associate them with synthetic hosts in a class-dependent manner
  - Simulated data is being used for LSST broker testing and classification pipeline development
- Realistic Type Ia Supernova Generation for Simulated Galaxies** Summer 2019  
*Advised by Prof. Renée Hložek, Dunlap Institute for Astronomy & Astrophysics*
- Assessed the effectiveness of EmpiriciSN, a machine learning algorithm to simulate Type Ia supernovae given properties of simulated host galaxies
- Senior Thesis, Megamaser Cosmology Project** 2017-2018  
*Advised by Dr. James Braatz, National Radio Astronomy Observatory*
- Investigated sources of uncertainty within the Megamaser Cosmology Project as well as cosmological implications of the results as of 2018
- Analysis of Galaxy Bulge + Disk Decomposition** Summer 2017  
*Advised by Prof. David Sanders, REU at the Institute for Astronomy at UH Manoa*
- Compared reliability of galaxy bulge+disk decomposition between SDSS and Pan-STARRS imaging

**Measuring the Orbit of Segue I** 2016-2017  
*Advised by Prof. Nitya Kallivayalil, UVA Astronomy Dept.*

- Measured the proper motion and orbit of the ultra-faint dwarf galaxy Segue I by comparing SDSS and LBT imaging

**Searching for new superconducting materials** 2015-2016  
*Advised by Prof. Despina Louca, UVA Physics Dept.*

- Prepared and characterized samples in a condensed matter physics laboratory for superconductivity testing

## HONORS AND AWARDS

---

Natural Science and Engineering Research Council of Canada PGS D (National)	2021-2023
Queen Elizabeth II Graduate Scholarship in Science and Technology (Provincial)	2020-2021
Massey College Junior Fellow (Institutional)	2019-2021
CITA Entrance Scholarship (Departmental, U of T)	2018-2019
NSF Graduate Research Fellowship Program (national, award offered)	2018
Limber Award (Departmental, UVA Astronomy)	2018
Raven Society (Institutional, UVA honor society)	2018
Sigma Pi Sigma (National, physics honor society)	2017
Vyssotsky Prize (Departmental, UVA)	2017
Prentiss Global Scholarship (Institutional, UVA scholarship for education abroad)	2016-2017
Corning Glass Works Scholarship (Private, Rhode Island Foundation)	2014-2017
UVA Intermediate Honors (Institutional, UVA top 20% of each College after 2 <sup>nd</sup> year)	2016
Minerva Award (Institutional, UVA undergraduate summer research grant)	2016

## TEACHING EXPERIENCE

---

**Directed Reading Program Lead** 2022-2023  
*Organizing and facilitating a focused cosmology reading group for 3 undergraduates*

**Teaching Assistant**, University of Toronto Department of Astronomy & Astrophysics undergraduate courses  
*Lead tutorials, managed email and discussion boards, marked exams, invigilated exams*

Stars and Galaxies (201)	Spring 2019, Summer 2020, Spring 2022
Galaxies and Cosmology (222)	Spring 2021
Origin and Evolution of the Universe (121)	Spring 2020
Programming Support TA, serving various U of T astronomy courses	Fall 2020
The Sun and its Neighbors (101)	Fall 2018, Fall 2019

**Public Planetarium Presenter** 2019  
 Dunlap Institute for Astronomy & Astrophysics

**Global Teaching Project Tutor** 2017-2018  
 Web tutoring for Albemarle, Mississippi high school AP Physics pilot program

## LEADERSHIP AND SERVICE

---

<b>CITA Visitors' Committee</b>	Fall 2022 -
<b>U of T Graduate Astronomy Student Association</b>	
Graduate peer mentorship coordinator	2019-2020, 2021-2022
Host of 'Talk Show' (programming to improve the astro grad student experience)	2020-2021
<b>U of T Antiracism Committee</b>	2021-2022
Regular host of learning and action meetings on promoting racial equity in astronomy	
<b>Canadian Astronomical Society Graduate Student Committee</b>	2020-2022
Environmental sustainability representative	
<b>Canadian Astronomical Society Sustainability Committee</b>	2020-2022
Graduate representative	
<b>Canadian Astronomical Society Annual General Meeting</b>	2021
Online Organizing Committee member	
<b>U of T Astro Tours</b> , monthly public outreach event	
Co-Director	2018-2019
Planetarium Director	Fall 2018
<b>UVA Astronomy Club</b>	2017-2018
Events coordinator, main organizer for outreach to local high schools	

## OUTREACH

---

<b>U of T AstroTours Public Talk</b>	2022
<i>Filamentary, my dear Watson: How the cosmic web can help us solve the universe's mysteries</i>	
<b>Pursue STEM Astronomy Workshop</b>	2021
Toronto-based outreach program that encourages and supports Black students in STEM	
<b>U of T Graduate Astronomy Student Association:</b> peer mentor, undergrad mentor	2019-2021
<b>Massey College Tutoring Program:</b> High school science and math tutor	2019-2020
<b>U of T AstroTours volunteer</b>	2018-2020
Various positions incl. planetarium presenter, Oculus Rift operator	
<b>UVA Society of Physics Students:</b> Peer Mentor	2017-2018
<b>UVA McCormick Observatory Public Night:</b> regular volunteer	2015-2018
<b>Charlottesville Boys and Girls Club After-School Reading Program</b>	2016, 2017
Designed and facilitated STEM-focused activities for elementary school children	
<b>Fan Mountain Observatory Public Night:</b> volunteer	2015-2017
<b>UVA Physics Day Show:</b> planned and presented lesson on spectroscopy	2017
<b>Central Virginia Star Party:</b> volunteer	2017
<b>NANOGrav:</b> Space Public Outreach Team Ambassador (presented at local schools)	2016

## RESEARCH PRESENTATIONS

---

<i>Anisotropic Superclustering of Cosmic Gas: an analysis with ACT+Planck and DES data.</i> Talk. Cosmo'22 Conference, Rio de Janeiro, Brazil	2022
<i>Anisotropic Superclustering of Cosmic Gas.</i> Talk. Cosmology from Home Conference, virtual. ( <a href="#">Link</a> )	2022
<i>Aligning the Cosmic Web: Superclustering at the intersection of ACT+DES data and simulations.</i> Talk. Tri-State Cosmology Meeting, Center for Computational Astrophysics University of Pennsylvania Department of Physics and Astronomy Cosmo Lunch, Princeton University / Institute for Advanced Study	2022 2022 2022
<i>The Simulated Catalogue of Optical Transients and Correlated Hosts.</i> Poster. Canadian Astronomical Society Conference (virtual)	2022
<i>Uncovering the Universe's Past with the Sunyaev-Zel'dovich Effect.</i> Invited hour-long seminar. <b>M. Lokken</b> and M. Ikape. University of Washington Bothell REU Program (virtual)	2021
<i>Simulating Host Galaxies for Transients in PLAsTiCC V2.</i> Invited hour-long colloquium. <b>M. Lokken</b> and A. Gagliano. Transient and Variable Science Colloquium, LSST (virtual)	2021
<i>Evidence for Anisotropic Superclustering of Thermal Energy in ACTxDES.</i> Talk. Canadian Astronomical Society Conference (virtual)	2021
<i>Slicing the Cosmic Web: A Recipe for Analyzing Gas Signal from Superclusters.</i> Poster. Canadian Astronomical Society Conference (virtual)	2020
<i>A Comparison of Superclustering in the Cosmic Web: ACTxDES Data vs. Peak-Patch Simulations.</i> Talk. Canadian Astronomical Society Conference, Montreal, Quebec	2019
<i>A Comparison of Galaxy Bulge+Disk Decomposition Between Pan-STARRS and SDSS.</i> Poster. 231 <sup>st</sup> meeting of the American Astronomical Society Mid-Atlantic Conference for Undergraduate Women in Physics, UVA Astronomy Undergraduate Research Symposium, UVA. 1 <sup>st</sup> place prize.	2018 2018 2018
<i>Galaxy Bulge+Disk Decomposition with Pan-STARRS and SDSS.</i> Talk. UVA Sigma Pi Sigma Research Symposium. 1 <sup>st</sup> place prize.	2017
<i>Creating a Phase Diagram for Superconducting <math>\text{Na}_x\text{Fe}_2\text{Se}_2</math>.</i> Poster. USOAR Research Symposium, UVA	2016

## WORKSHOPS

---

• Atacama Cosmology Telescope Data School (virtual)	2021
• Michigan Cosmology Summer School (virtual)	2020
• Advancing Theoretical Astrophysics University of Amsterdam, the Netherlands	2019
• Atacama Cosmology Telescope Data School Princeton University, NJ	2019
• Data Visualization in the Era of Machine Learning Hackathon University of Toronto	2019

## PUBLICATIONS

---

### PEER REVIEWED, MAIN AUTHOR

*Order in author list indicates level of contribution, with 1<sup>st</sup> being lead author. Blue text links to the arXiv.*

Oriented tSZ signal from unbound gas in protoclusters: the Gizmo-Simba ThreeHundred runs

**Lokken, M.**, Cui, W., et al., in prep.

Superclustering with the Atacama Cosmology Telescope and Dark Energy Survey: II. Anisotropic relationships between gas, galaxies, and dark matter

**Lokken, M.**, Hložek, R., van Engelen, A., et al., in prep.

Superclustering with the Atacama Cosmology Telescope and Dark Energy Survey: I. Evidence for thermal energy anisotropy using oriented stacking

**Lokken, M.**, Hložek, R., van Engelen, A., et al. 2022, ApJ Volume 933, Issue 2, id.134. [arXiv:2107.05523](#)

The Simulated Catalogue of Optical Transients and Correlated Hosts (SCOTCH)

**Lokken, M.**, Gagliano, A., et al. 2022. *Submitted to MNRAS*. [arXiv: 2206.02815](#)

The Orbit and Origin of the Ultra-faint Dwarf Galaxy Segue 1

Fritz T., **Lokken M.**, Kallivayalil N., et al., 2018, ApJ, 860, 164. [arXiv: 1711.09097](#)

### PEER REVIEWED, LARGE COLLABORATION

*Provided feedback on scientific content, writing style, and organization of the paper*

Probing Galaxy Evolution in Massive Clusters Using ACT and DES: Splashback as a Cosmic Clock

Adhikari, S., et al. incl. **Lokken, M.** 2021. ApJ Volume 923, Issue 1, id.37. [arXiv:2008.11663](#)

A high-resolution view of the filament of gas between Abell 399 and Abell 401 from the Atacama Cosmology Telescope and MUSTANG-2

Hincks, A., et al. 2021. incl. **Lokken, M.** MNRAS Volume 510, Issue 3. [arXiv:2107.04611](#)

The mass and galaxy distribution around SZ-selected clusters

Shin, T., et al. 2021. incl. **Lokken, M.** MNRAS Volume 507, Issue 4. [arXiv:2105.05914](#)

Cross-correlation of DES Y3 lensing and ACT/Planck thermal Sunyaev Zel'dovich Effect II: Modeling and constraints on halo pressure profiles

Pandey, S., et al. incl. **Lokken, M.** 2021. PRD, Volume 105, Issue 12, article id.123526. [arXiv:2108.01601](#)

Cross-correlation of DES Y3 lensing and ACT/Planck thermal Sunyaev Zel'dovich Effect I: Measurements, systematics tests, and feedback model constraints

Gatti, M., et al. incl. **Lokken, M.** 2021. PRD Volume 105, Issue 12, article id. 123525. [arXiv:2108.01600](#)

The Atacama Cosmology Telescope: Probing the baryon content of SDSS DR15 galaxies with the thermal and kinematic Sunyaev-Zel'dovich effects

Vavagiakis, E., et al. incl. **Lokken, M.** 2021. PRD Volume 104, Issue 4, article id.043503. [arXiv:2101.08373](#)

The Atacama Cosmology Telescope: Detection of the pairwise kinematic Sunyaev-Zel'dovich effect with SDSS DR15 galaxies

Calafut, V., et al. 2021. incl. **Lokken, M.** PRD Volume 104, Issue 4, article id.043502. [arXiv:2101.08374](#)

The Atacama Cosmology Telescope: A Catalog of >4000 Sunyaev-Zel'dovich Galaxy Clusters

Hilton, M., et al. incl. **Lokken, M.** 2021. ApJS Volume 253, Issue 1, article id. 3, 25 pp. (2021). [arXiv:2009.11043](#)

The Atacama Cosmology Telescope: DR4 maps and cosmological parameters  
Aiola, S., et al. incl. **Lokken, M.** 2020. JCAP Issue 12, article id. 047. [arXiv:2007.07288](https://arxiv.org/abs/2007.07288)

The Atacama Cosmology Telescope: a measurement of the Cosmic Microwave Background power spectra at 98 and 150 GHz  
Choi, S., et al. incl. **Lokken, M.** 2020. JCAP Issue 12, article id. 045 (2020). [arXiv:2007.07289](https://arxiv.org/abs/2007.07289)

Atacama Cosmology Telescope: Component-separated maps of CMB temperature and the thermal Sunyaev-Zel'dovich effect  
Madhavacheril, M., et al. incl. **Lokken, M.** 2020. PRD Volume 102, Issue 2, article id.023534. [arXiv:1911.05717](https://arxiv.org/abs/1911.05717)

## NON-PEER REVIEWED

The Significance of Precision Cosmology  
**Lokken, M.** and Hložek, R. 2022. Mercury Magazine, Volume 50, No. 4

Canadian Astronomy, Racism, and the Environment (Parts I and II).  
**Lokken, M.**, et al., Autumn 2020 and Spring 2021 editions of Cassiopeia, the Canadian Astronomical Society quarterly newsletter

Astronomy in a Low-Carbon Future: A White Paper for the 2020 Long Range Plan  
Matzner, C.D., et al. incl. **Lokken, M.** 2019. [arXiv:1910.01272](https://arxiv.org/abs/1910.01272). Main contributor.

Uncertainties and Cosmological Constraints from the Megamaser Cosmology Project  
**Lokken M.** 2018. Senior Thesis, Bachelor's. University of Virginia. <https://doi.org/10.18130/V3JS9H73D>

Female Physics Students Unite at UVa  
**Lokken, M.** 2018. University of Virginia Physics News, Vol 7, No. 1

## COLLABORATIONS

---

Atacama Cosmology Telescope	2019-present
LSST Dark Energy Science Collaboration <i>Extended LSST Astronomical Time-Series Classification Challenge (ELAsTiCC) team member</i> <i>Internal manuscript reviewer, 2022</i>	2019-present
External Collaborator, Dark Energy Survey	2019-present
The ThreeHundred Project	2022-present

## MEDIA

---

Quoted in “Our feverish universe is getting hotter every day,” Christopher Crockett, Jan 11, 2021, [Science News Explores](https://www.sciencenews.org/explores).

Research profiled, quoted in “U of T astronomers are helping find the missing universe,” Chris Sasaki, July 12, 2022, [U of T News](https://www.utoronto.ca/news/2022/07/12/missing-universe).

“The Stars are Aligned, the Future of Astrophysics,” a publicly-streamed conversation with Dr. Juna Kollmeier and Aarya Patil, May 5, 2021, [Massey Dialogues](https://www.masseydialogues.com/).