

# Martine Lokken

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## EDUCATION

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### University of Toronto

PhD, David A. Dunlap Department of Astronomy & Astrophysics  
Advisors: Prof. J. Richard Bond and Prof. Renée Hložek

Sep. 2018 – Jul. 2023 (expected)

### University of Virginia

BS, Astronomy-Physics, Highest Distinction

Aug. 2014 – May 2018

### University of Edinburgh

Semester Abroad

Fall 2016

## HONORS AND AWARDS

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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

## RESEARCH PROJECTS

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### Effects of AGN feedback on warm-hot gas in superclusters

2022-present

*In collaboration with the ThreeHundred Cluster Project and Simba simulation group*

- Analyzing tSZ signals in filaments in the ThreeHundred Cluster Gizmo-Simba runs
- Re-simulating larger regions around selected ThreeHundred clusters in large scale high-superclustering regions with Gizmo-Simba physics and varying AGN feedback
- Analyzing impact of AGN feedback on anisotropic thermal Sunyaev-Zel'dovich signal from superclusters

### 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
- Applying techniques developed throughout my PhD to assess their sensitivity to variations in cosmology

**Investigating superclustering in cosmic gas****2018-present***Advised by Prof. J. Richard Bond and Prof. Renée Hložek, University of Toronto*

- Developing and testing novel statistical methods 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***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 1****2016-2017***Advised by Prof. Nitya Kallivayalil, UVA Astronomy Dept.*

- Measured the proper motion and orbit of the ultra-faint dwarf galaxy Segue 1 by comparing SDSS and LBT imaging

**Condensed Matter Physics****2015-2016***Advised by Prof. Despina Louca, UVA Physics Dept.*

- Prepared and characterized samples for superconductivity testing

**SCIENTIFIC JOURNAL PUBLICATIONS**

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**MAIN AUTHOR**

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

## COLLABORATION

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. 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. 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

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

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

## OTHER PUBLICATIONS

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

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

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

## RESEARCH PRESENTATIONS

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<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="https://www.youtube.com/watch?v=DwoWIpYNJhU&amp;ab_channel=CosmologyfromHome">https://www.youtube.com/watch?v=DwoWIpYNJhU&amp;ab_channel=CosmologyfromHome</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 talk. M. Lokken and M. Ikape. University of Washington Bothell REU Program (virtual)	2021
<i>Simulating Host Galaxies for Transients in PLAsTiCC V2.</i> Invited talk. M. Lokken 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

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• 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

## TEACHING EXPERIENCE

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<b>Directed Reading Program Lead</b> <i>Organizing and facilitating a focused cosmology reading group for 3 undergraduates</i>	<b>2022-2023</b>
<b>Teaching Assistant</b> , University of Toronto undergraduate courses <i>Lead tutorials, managed email and discussion boards, marked exams, invigilated exams</i>	
AST201 Stars and Galaxies	<b>Spring 2019, Summer 2020, Spring 2022</b>
AST222 Galaxies and Cosmology	<b>Spring 2021</b>
AST121 Origin and Evolution of the Universe	<b>Spring 2020</b>
Programming Support TA, serving various U of T astronomy courses	<b>Fall 2020</b>
AST101 The Sun and its Neighbors	<b>Fall 2018, Fall 2019</b>
<b>Public Planetarium Presenter</b> Dunlap Institute for Astronomy & Astrophysics	<b>2019</b>
<b>Global Teaching Project Tutor</b> Web tutoring for Albemarle, Mississippi high school AP Physics pilot program	<b>2017-2018</b>

## LEADERSHIP AND SERVICE

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

## OUTREACH

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