Carter Rhea | Master's Student in Observational Galactic Astronomy

L'Université de Montréal

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🌐 https://crhea93.github.io

Education

L'Université de Montréal   **Montréal, QC CA**
PhD, GPA: 4.0   *2020-present*
Advisor: Professor Julie Hlavacek-Larrondo

L'Université de Montréal   **Montréal, QC CA**
Master of Science, GPA: 4.0   *2018-2020*
Advisor: Professor Julie Hlavacek-Larrondo
Thesis:X-ray Investigation of a High-Reshift Galaxy Cluster Undergoing Elevated Stellar Formation

Duke University   **Durham,NC USA**
Master of Science, GPA: 3.765   *2016-2018*
Advisor: Dr. John Dolbow
Thesis: Fluid Flow in Hele-Shaw Cells

College of Charleston   **Charleston,SC USA**
B.Sc. and B.A., GPA: 3.923   *2012-2016*
Graduated Summa Cum Laude
B.Sc. in Pure Mathematics (fulfilled requirements for Applied Degree)
B.A. in Astronomy
Minors in Geology and Russian Studies

Research Expertise

Multiwavelength Studies of Galaxy Cluster
Lead and participated in several X-ray and optical studies

Development of Software for Astronomical Analysis
Created several tools and pipelines for x-ray photometric and spectroscopic analysis

Machine Learning Techniques in Astronomy
P.I. on several papers using machine learning techniques

Awards

IVADO
Prix du public - Octobre Numérique   *2020*

MITACS et L'Université de Montréal
Bourse de MITACS pour l'Été   *2020*

L'Université de Montréal
Bourse d'exemption des droits de scolarité supplemémentaires 2020

IVADO et L'Université de Montréal
Bourse d'IVADO d'excellence pour le doctorat 2020-present

L'Université de Montréal
Bourse de Hubert Reeves 2020

L'Université de Montréal
Bourse de recrutement du Département de physique 2018

L'Université de Montréal
Bourse d'exemption des droits de scolarité supplemémentaires 2018

Duke University
Pratt-Gardner Graduate Fellowship 2016-2018

College of Charlestson
Honorable Mention for COMAP 2016

College of Charlestson
Outstanding Student Award in Mathematics 2015 & 2016

College of Charlestson
Merit award at School of Science and Math Poster Session 2016

College of Charleston
Horation Hughes Scholarship for Mathematics 2015-2016

College of Charlestson
Outstanding Undergraduate Research Award in Astronomy 2015

College of Charleston
School of Science and Mathematics Summer Research Stipend 2015

College of Charlestson
Russian Language Award from the Russian Language Teachers of America Society 2014

College of Charleston
Horatio Hughes Scholarship for Physics 2014-2016

College of Charlestson
Faculty Honors and Dean's list honors 2012-2016

College of Charleston
SC LIFE STEM Extension 2012-2016

College of Charleston
College of Charleston Foundation Scholarship 2012-2016

College of Charleston
College of Charleston Merit Scholarship 2012-2016

College of Charleston
SC LIFE Scholarship 2012-2016

Observation Proposals

CFHT SITELLE   **PI**
Mapping The Entire Filamentary Nebula In M87 At A High Spectral Resolution   *2020B*
2020BC001

CFHT SITELLE   **PI**
Novel Observations of Brightest Cluster Galaxies with the CFHT   *2020A*
DDT/20AD99

L'Observatoire de Mont Mégantic   **PI**
Une enquête sur l'emission Halpha dans une système complèxe
de fusions galactiques   *2020A*

Jansky Very Large Array   **Co-I**
Imaging the coma cluster of galaxies with the JVLA   *2020A*
VLA/20A-198

Gemini North Observatory   **Co-I**
Confirming the X-ray Detection of a z=1.7 Galaxy Cluster   *2019A*
DDT

XMM-Newton   **Co-I**
Magnified Views of Relativistic Outflows in gravitationally Lensed mini-BALQSO   *2015*
76252

Publications

A Novel Machine Learning Approach to Disentangle
Multi-Temperature Regions in Galaxy Clusters   **2020**
Rhea, C.L., et al.   *Astronomical Journal*
arxiv:2009.00643

A Machine Learning Approach to Integral Field Unit
Spectroscopy Observations: I. HII Region Kinematics   **2020**
Rhea, C.L., et al.   *Astrophysical Journal*
arxiv:2008.08093

Runaway gas cooling in the absence of supermassive black hole
feedback at the epoch of cluster formation   **2020**
Hlavacek-Larrondo, J., Rhea, C.L., et al.   *Astrophysical Journal Letters*
arxiv:2007.15660

A Multiwavelength Study of Massive Cool Core Cluster
MACS J1447.4+0827   **2020**
Prasow-Emond, M., Hlavacek-larrondo, J, Rhea, C.L., et al.   *Astronomical Journal*
arxiv:2006.04815

On the relation between mini-halos and AGN feedback in clusters of galaxies   **2020**
Richard-Laferrière, A., et al.   *MNRAS*
arxiv:2007.01306

Simulation of Fracture in Particulate Rafts   **2018**
Peco, C., Liu, Y., Rhea, C., Dolbow, J.   *International Journal of Solids and Structures*

Gravitational Lensing Size Scales for Quasars   **2016**
Chartas, G., Rhea, C., et al.   *Astronomiche Nachrichten*
arxiv: 1509.05375

Talks and Posters

Harvard-Smithsonian Center for Astrophysis   **2021**
Machine Learning & Galaxy Clusters   *Virtual*
Invited Talk; 1 hour

American Astronomical Society Meeting 237   **2021**
A Machine Learning Approach to SITELLE Data   *Virtual*
Contributed Talk; 10 min

Astronomical Data Analysis Software and Systems   **2020**
A Machine Learning Approach to SITELLE Data   *Virtual*
Poster

Ivado: Digital October   **2020**
A Machine Learning Approach to SITELLE Data   *Virtual*
Contributed Talk: 15 min

Cambridge University: Epoch of Galaxy Formation   **2020**
When a Black Hole Fails to do its Job   *Virtual*
Contributed Talk: 15 min

Australian National University Astotalks Series   **2020**
A Machine Learning Approach to SITELLE Data   *Virtual*
Invited Talk; 30 min

CASCA CANVAS   **2020**
A Machine Learning Approach to SITELLE Data   *Virtual*
Invited Talk; 1 hour

SIGNALS Photoionization Workshop   **2020**
A Machine Learning Approach to SITELLE Data   *Virtual*
Invited Talk; 15 min

CASCA Annual General Meeting   **2020**
Runaway gas cooling in the absence of SMBH feedback at the epoch of cluster formation Toronto, ON (virtual)
Poster

Canada France Hawaii Telescope Colloquium Series   **2020**
A Machine Learning Approach to Sitelle Spectral Analysis: I. HII Region Kinematics Hilo, Hawaii
Invited Speaker; 45 min

20 Years of Chandra   **2019**
Extreme Stellar Formation in a z=1.7 Galaxy Cluster   Boston, MA
Poster

McGill Physics Codetober 2019   **2019**
Git & Github   Montréal, QC
Invited Speaker

The 12th Great Lakes Cosmology Workshop   **2019**
The Massive Galaxy Cluster SpARCS1049: A History   Rochester, NY
Selected Speaker; 15min

CASCA Annual General Meeting   **2019**
Explaining the Formidable Stellar Formation
Rate of a Massive Galaxy Cluster at z=1.7   Montréal, QC
Poster

Politics, Physiology, and Cognition: Advances in Theory and Method **2019**
Cognitive Affective Maps   Montréal, QC
Invited Speaker

CRAQ Annual Meeting   **2019**
Extreme Stellar Formation in a z=1.7 Galaxy Cluster   *Lac de l'Eau Claire, QC*
Speaker

XMM-Newton 2015 Science Workshop   **2015**
Measuring the Spin Parameter of the Supermassive Black Hole RXJ 1131-1231   *Madrid, Spain*
Poster

Experience

Research..

Canada France Hawaii Telescope   **Waimea, HI, USA**
Research Intern   *February 2020 - May 2020*
A Machine Learning Approach to Sitelle Spectral Analysis
Detailed achievements:
- Developed machine learning algorithm to determine the velocity and broadening spectral parameters
- Interfaced this technique with the `ORCS` analysis software for Sitelle

L'Université de Montréal   **Montréal QC, CA**
Research Assistant   *2018–present*
Dynamics of young galaxy clutsers undergoing extreme starburst activity
Detailed achievements:
- Developed several programs for X-ray data analysis for use in the lab (see https://github.com/crhea93/AstronomyTools)
- Lead research determining the cause of extreme starburt in the galaxy cluster *SpARCS1049+56*
- Leading efforts to study M87 using novel SITELLE observations

Duke University   **Durham,NC USA**
Research Assistant   *2016–2018*
Continuing research studies on the particulate raft systems and their interaction with surfactants
Detailed achievements:
- Developed large-scale C++ program to calculate packing fraction for particulate raft systems
- Integrated several C++ and python programs into MOOSE (DOE supplied FEM code)
- Conducted studies on the effect of differing packing fraction structure on the flow of surfactants in particulate rafts
- Created Phase Diagram of mechanical fracture systems after adapting KL Eigenvalue Expansion technique's to the material's Young's Modulus

College of Charleston   **Charleston, SC USA**
Research Assistant   *2013–2015*
The inflows and outflows of supermassive black holes through focusing on their accretion disk structure and magnification caustic.
Detailed achievements:
- Participated in several Colloquium talks at the College of Charleston;
- Completed Senior Research Project entitled "Measure the spin of the Supermassive Black Hole RXJ1131";
- 15-minute research talk at the 2015 Colonial Academic Alliance Undergraduate Research Conference at Drexel University;
- Poster Presentation at the European Space Agency's conference: The Extremes of Black Hole Accretion (8-10 June 2015 in Madrid, Spain)

College of Charleston **Charleston,SC USA**

Research Assistant *2012*

Modeling the solutions to the vortex filament equation in order to better understand their underlying structure.

Detailed achievements:

- ◦ "Numerical Investigations of Models of Vortex Filaments" at the College of Charleston School of Science and Mathematics 2016 Undergraduate Poster Session held at SSM, Charleston, SC on April 14,2016

Programming

Cadena **Montréal QC, CA**

Co-founder, Lead Developper, and Webmaster *2019–present*

Non-profit company bringing affordable textbook prices to students

Detailed achievements:

- ◦ Created a fully funcitonal web-app for book sales and trades (bi-lingual site): https://www.cadena.ca
- ◦ Worked closely with development team in order to optimize workflow
- ◦ Ensured secure transactions and general site security as webmaster

Teaching and Tutoring

College of Charleston   **Charleston ,SC USA**
Teaching Assistant   *2012-2018*
Detailed achievements:
- Teaching Assistant for introductory geology labs (2013 - 5 labs total)
- Additional instruction and grading for introductory geology lecture (2013)
- Assistant for Axiomatic Geometry: grading and additional instruction (2015)
- Assistant for Complex Variable Analysis: grading and additional instruction including weekly recitation hours (2016)

Duke University   **Durham, NC USA**
Teaching Assistant   *2016-2018*
Detailed achievements:
- Assistant Professor for introductory course on Monte Carlo Markov Chains and program- ming for incoming Freshman (Summer 2017)
  - Grading and biweekly recitation hours
  - Biweekly class on programing in python and Monte Carlo Markov Chains
  - Developed all lab curriculum on python programming
- Recitation session leader for the following courses:
  - Calculus II
  - Multivariable Calculus
  - Linear Algebra and Differential Equations for Engineers
  - Ordinary and Partial Differential Equations for Engineers

College of Charleston   **Charleston, SC**
Certified Tutor   *2012-2016*
Language And math tutor
Detailed achievements:
- Math tutor specializing in calculus and differential equations
- Worked as Russian Language Tutor helping students learn the intricacies of Russian grammar and composition
- Certified Russian Language Tutor

L'Université de Montréal   **Montréal, QC, CA**
Teaching Assistant   *2018-present*
As a teaching assistant, I am required to host bi-weekly recitation hours (*en français*) and grade.
Courses:
- Mécanique et Physique Moderne (Fall 2018)
- Mécanique Classique I (Spring 2019)
- Optique et Ondes Électromagnétique (Fall 2019 & 2020)

Observational

Observatoire Mont Mégantic   **La Patrie, Québec Canada**
Graduate Student Observer   *2018-Present*
- Assisted in the collection of observational data using the 1.6m telescope situated in the Canadian nature preserve Mont Mégantic
- Familiarized with the astronomical methods and instrumentation of small (relatively) telescopes under the supervision of the night technician

Outreach

                                                       Montréal, Québec Canada
Outreach Volunteer   *2018-Present*

- Volunteer at the Astronomie en fût event
- Presenter at the Astronomie en fût event (January 2019 *en français*)
- Presenter at Constellation de conférences d'IREX (28 Nov, 2018 *en français*)
- Presenter at Jeunes Explorateurs à l'UdEM (11 April, 2019 *en français*)
- Conferencier at Astronome dans la classe (17 May, 2019 *en français*)
- Mentor at the McGill Physics 2019 Hackathon (48 hours)

Montréal, Québec Canada

Canadian Astronomical Society Graduate Student Committee Vice Chair   *2019-2020*
- Organized 2019 CASCA GSC Graduate Student Workshop and designed website: http://www.physics.mcgill.ca/casca2019/CASCA_GSC_Workshop/
- Leading GSC social media presence

Montréal, Québec Canada

Canadian Astronomical Society Graduate Student Committee Chair   *2020-Present*
- Leading GSC social media presence
- Secured graduate student involvement in CASCA's weekly CANVAS talks.

Workshops

- University Of Toronto Dunlap Summer School in Astronomical Instrumentation, July 7-13, 2019
- CFHT Photo-Ionization Online Workshop, June 8-19, 2020

Languages

English: **Mothertoungue**

French: **Advanced**   *Conversationally Fluent*

Spanish: **Intermediate**   *Competent in Reading, Writing and Speaking*

Russian: **Intermediate**   *Competent in Reading, Writing, and Speaking*

Programming Languages

Basic: **IDL, Julia, Octave**

Intermediate: LATEX, **Java**, **HTML**, **SQL**, **JavaScript**, **Ajax**, **PHP**

Advanced: **Python, C++,Django, JQuery**