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UofT AstroDoings Newsletter – Sept 2019



Dear All,

I hope everyone has enjoyed the summer and is reinvigorated and ready for the exciting year ahead! Our Department had a great and eventful 2018-2019 academic year and this newsletter will attempt to cover our most important milestones.



This summer we welcomed Professor Gwendolyn Eadie, past Dirac Fellow at the University of Washington, who has accepted our offer of a joint tenure stream faculty position from the Departments of Astronomy & Astrophysics and the Department of Statistics. Although Gwen is cross appointed in two Departments, she has elected to make the Department of Astronomy and Astrophysics her home. Gwen started her position in August, and she can be found in office AB220. Gwen will be teaching a joint graduate course

in Astro-statistics in the winter term. She is already leading the development of a white paper for the Canadian Long-Range Plan for Astronomy and Astrophysics on various aspects of Astrostatistics. Welcome Gwen!



We also welcomed two new Assistant Professors (Contractually Limited Term Appointments, CLTA) for this fall. They are Jeremy Webb and Rachel Friesen. Jeremy is a former National Science and Engineering Research Council of Canada (NSERC) postdoctoral fellow from our own Department. His research is focused on the evolution of

star clusters in cosmologically motivated tidal fields. Rachel is a former NSERC of Canada postdoctoral fellow at

the Dunlap Institute for Astronomy and Astrophysics and the Canadian Institute for Theoretical Astrophysics (CITA) at the University of Toronto. Her research is focused on characterizing the multiwavelength signatures of black hole evolution and feedback. They are both excited to continue working in our Department and contributing to its ongoing research and teaching programs.



For the past six months we were busy preparing for the next intake of fourteen new graduate students, all of whom started this month. We received 33 domestic and 119 international applications. The selection process was particularly difficult this year since both domestic and international cohorts had many highly competitive candidates. Kudos to our graduate team for the great work they have done!

Our most recent Departmental Summer Party was held on July 19_{th}, 2019 at the Faculty Club. We had a great turnout with about 90 faculty members and trainees in attendance. The next event is planned for September 27th. Please attend. Our Departmental parties are an excellent opportunity not only to socialize but to reinforce existing and establish new collaborations, exchange knowledge and help to strengthen our academic community at DAA, the Dunlap Institute, CITA and Center for Planetary Science (CPS).

In 2018-19 the entire Graduate Department (all of astronomy and astrophysics at the University of Toronto) underwent a University of Toronto Quality Assurance Process (UTQAP) review. This is a deep dive into our primary mission of teaching graduate and undergraduate students in a research focussed environment. Along with our narrative there are all sorts of metrics describing students, teaching and research relative to our past performance and relative to peer institutions. Very nice to see virtually every curve rising steadily upward. However, we have a complicated set of administrative structure which leads to some complications. Accordingly, this academic year, we are planning to start working on formation of the Graduate Department's Community Committee. This process will engage our faculty, staff and students. We hope that everybody will be able to participate as your ideas and contributions are deeply valued and will impact the success of our initiative. Our goal is to have the planning process completed by the end of the calendar year.

As usual, there are other exciting activities within DAA and other astronomy units at the University. The most exciting upcoming event in our Department, taking place on September 30,

2019, is the Inaugural Martin Scholarship Lecture. Lord Martin Rees graciously agreed to give this lecture. More details can be found below.

Best wishes,

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Raymond Carlberg Professor and Chair, Department of Astronomy and Astrophysics

We are Welcoming Our New Cohort of Graduate Students

- Seery Chen from McGill University
- Daven Cocroft from University of Washington, USA
- Amanda Cook from McGill University
- Easha Das Gupta from Drexel University, Pennsylvania, USA
- Jibran Haider from University of Richmond, Virginia, USA
- Fergus Horrobin from University of Toronto, Scarborough
- Adaeze Ibik from University of Nigeria, Nigeria
- Shivan Khullar from Birla Institute of Technology and Science, Jharkhand, India
- Henry Leung from University of Toronto
- Guadalupe Lizana Estivill from University of Groningen, Netherlands
- Ashley Stock from University of Saskatchewan
- Jacob Taylor from University of Toronto
- Aaron Tohuvavohu from Reed College, Oregon, USA
- Shannon Vanderwoude from University of Toronto

Featured New Graduate Student: Aaron Tohuvavohu

by Alena Wasney

A couple of weeks ago, before our new cohort of students were set to arrive in Toronto, I had a chance to speak over the telephone with one of our new students, Aaron Tohuvavohu. Aaron is a remarkable young scientist whose track record speaks for itself. Thank you, Aaron, for finding time to speak to me!

Aaron grew up in New York and went to school in Portland, Oregon where he received his degree in Physics. As an undergrad, Aaron focused on theoretical physics and his thesis, entitled "Issues with First Quantization Quantum Mechanics on Curved Space-times", reflected his interest in this field. After undergrad, Aaron started working for NASA's Neil Gehrels Swift Observatory, where he spent the next three years working on the mission and rising rapidly to become the first individual without a Ph.D. to take the post of Observatory Duty Scientist.



At Swift, Aaron was exposed to various scientific projects while working with numerous people all over the world. He spearheaded and led the way to optimize the Swift Observatory's chances of catching new events, in particular high-energy electromagnetic counterparts to gravitational waves. Even though Aaron's position at Swift was very fulfilling and full of never-ending challenges, he realized that in order to move forward he needed to obtain a higher degree and acquire more broad knowledge. Therefore, he decided to pursue his PhD degree in Astronomy.

Aaron chose the U of T because Toronto is a great city which has a lot to offer in terms of culture and science. It is multicultural, open and friendly. Aaron's impression after vising our department is that we have great scholars and happy students. It also helps that its three units (DAA, The Dunlap Institute and CITA) work closely together, thereby increasing the opportunities for collaboration. Outside of academics, Aaron hopes that he will find friends to speak other languages (including Yiddish and Spanish). At this point in his career, his research interests are broad and include high energy transients and astrophysical tests of fundamental physics.

I asked Aaron why he decided to become an Astronomer and he told me that Astronomy is a perfect discipline because it is very versatile. Being an astronomer, one gets to work on large issues making connections across disciplines and utilizing many aspects of basic physics including relativity, thermodynamics, electromagnetism, statistical mechanics, nuclear and particle physics, quantum mechanics, and atomic and molecular physics. He likes the fact that modern astronomical research often involves both theoretical and observational components. Observational Astronomy is also a great way to travel and meet new people as astronomers are the most fun people you can find in physics departments!

Aaron's main hobby is learning – whether it is physics, languages, or other interests. He also mentioned regular naps and Ultimate Frisbee among his hobbies.

When I asked Aaron how he is hoping to make the world a better place, he gave me the most perfect answer. He said he is going to make the world better by following his passion for knowledge. He believes knowledge is fundamentally important for our development and progress and if there is anything he can contribute, it is to add to that knowledge.

We are very excited to welcome Aaron and all of our new graduate students to our department. We hope we will live up to the high standards and expectations!

Congratulations to our graduate students on successfully defending their theses

Dr. Jielai Zhang - June 28th, 2018 (Supervisors: Bob Abraham and Peter Martin). Thesis title: The Development and Scientific Application of the Dragonfly Telephoto Array. She is a Schmidt Science Fellow in Oxford.

- Dr. Peter Jumper August 24th, 2018 (Supervisor: Chris Matzner). Thesis title: Star Cluster Formation and Radiative Feedback.
- Dr. Robert Main August 30th, 2018 (Supervisors: Ue-Li Pen and Marten van Kerkwijk). Title: Resolving Pulsar Emission with Cosmic Microscopes. He is a Scientific Staff at the Max Planck Institute for Radio Astronomy.
- Dr. Nolan Denman January 21st, 2019 (Supervisor: Keith Vanderlinde). Thesis title: Digital Signal Processing for the Canadian Hydrogen Intensity Mapping Experiment. He is a Jansky Fellow at NRAO in Charlottesville.
- Dr. Ryan Cloutier May 17th, 2019 (Supervisor: Kristen Menou). Thesis title: Semiparametric Methods to Aid in the Detection and Characterization of Distant Worlds around Small Stars. He is a postdoctoral fellow at the Harvard and Smithsonian Center for Astrophysics.
- Dr. Epson Masikiv Heringer July 10th, 2019 (Supervisor: Marten van Kerkwijk). Thesis title: Multi-Faceted Investigation of the Supernova Ia Progenitor Problem.
- Dr. Elliot Meyer August 2nd, 2019 (Supervisor: Dae-Sik Moon), Thesis title: Variation in the Initial Mass Function of Nearby Galaxies: Instrumentation and Observations. He is planning to continue working with Professors Dae-Sik Moon and Suresh Sivanandam.
- Dr. George Stein August 13th, 2019 (Supervisor: Dick Bond). Thesis title: Mocking the Universe: Accurate Simulations in the Era of Large-Survey Precision Cosmology. He will be starting his postdoctoral fellowship in Berkley.
- Dr. Dana Simard August 26th, 2019 (Supervisor: Ue-Li Pen). Thesis title: Mapping Interstellar Plasma Structures in Space and Time through Global Interferometry of Pulsars. She will be starting her postdoctoral fellowship in Caltech.

Featured Astronomy Alumni: Dr. Jielai Zhang

Jielai, a gifted and enthusiastic graduate student, was named one of fourteen inaugural Schmidt Science Fellows. She kindly agreed to answer a few questions for our newsletter. We would like to thank Jielai for her time.

Could you briefly tell us about yourself? What would be the first thing you would like people to know about you? I'm always up for trying something new and fun.

When were you part of the DAA graduate program? Why did you go to UofT instead of other schools? 2012-2018. When I started graduate school, I wasn't sure what type of astronomy I wanted to do. In fact, I wasn't even sure if I wanted to do theory, observational astronomy or instrumentation. I had a feeling that I might like all of it. At the University of Toronto, there are three separate institutions, each dedicated to one aspect of astronomy: CITA for theory, the DAA with a lot of observational astronomers and Dunlap for instrumentation. Three separate institutions in my eyes meant that there were separate groups of people thinking about how best to do each of the three aspects of astronomy in one place, including separate resources for each endeavor. The University of Toronto seemed like the perfect place to get a sense of all aspects of



astronomy. Toronto as a city, and Canada as a country is known to be welcoming, full of nice people and I love snow. I had also never been to Canada before, so UofT really ticked all the boxes of good career move, great life choice with a touch of excitement because of the novelty.

Where are you now? What is your area of focus? Could you briefly tell us about your new research projects? What do you enjoy the most about being a part of the Schmidt Science Fellow Program?

In 2016, Gravitational Waves were observed for the first time. This, together with the growing field of transient astronomy sparked my imagination. What discoveries can we enjoy in the new parameter space that is the time domain on short timescales? I started imagining all the new types of observational techniques and programs needed to make discoveries in time domain astronomy. How should we treat the data coming in, and what about new telescopes we should build? One of my favourite aspects of my PhD was to build a telescope (The Dragonfly Telephoto Array), devise the observing techniques and write the software that allowed us to see the Universe in a new way.

As I was thinking about how to do transient astronomy, the Schmidt Science Fellows program came to my attention thanks to Margaret Meaney, the graduate administrator. The Schmidt Science Fellows program, in partnership with the Rhodes Trust, aims to give early career scientists the opportunity to explore different disciplines. The program believes that interdisciplinary thinkers can do the best science, and this is what is needed to solve the world's most pressing problems. I decided it would be incredible to learn from those who are at the cutting edge of applying machine learning to image analysis. The Schmidt Science Fellows program allowed me to take this year after my PhD and be placed as a postdoc in a medical imaging/ deep learning lab.

I am placed at the University of Oxford, Institute of Biomedical Engineering. I am hosted by Prof. Alison Noble and also collaborate closely with Dr. Ana Namburete, who is the lead of the Oxford Ultrasound NeuroImage Analysis Group. My research is to produce refined atlases of the developing fetal brain using 3D ultrasound data for fetuses affected by congenital heart disease or were born small for their gestational age. These atlases can be used to study fetal brain development and has the potential to improve ante-natal monitoring and fetal outcomes. My favourite aspect of being a Schmidt Science Fellow is being part of a large scientific family. I am part of the first cohort of Schmidt Science Fellows, and there are 14 of us. Over the course of the Fellowship year, we have become best friends who learn from each other not just about our science but also scientific ethics and leadership; we not only discuss our careers, but also our life choices, goals and what type of people we want to become. I am also part of the larger Fellowship family, the Fellowship staff have put together a program providing resources and support for fellows to aim high, while being completely ourselves. As part of this family, I don't feel what often comes with the prestige: that there is some pre-defined sense of what success is, and if I stray too far, I will be a disappointment. The family strongly believes that each of us can make great impact on the world's most pressing problems, but we are not made to feel there is somebody judging our every move and decision. This is a very nuanced balance that is hard to achieve, and it is what I hope to provide to all members of any collaborations I am part of, and any scientists I mentor in the future.

What did you value the most about your years with DAA?

Bob Abraham and Peter Martin were my PhD advisors. I would not have finished my PhD without Bob's enduring encouragement, advice and support. Not only is Bob an excellent scientific mentor, his appreciation of his students as multifaceted individuals, his continuous motivation for learning how best to supervise, and his infinite passion for the work we did together are aspects of being a scientist I will always return to in times of success and times of trial. Peter's meticulous approach to understanding data and data statistics were invaluable in teaching me how to balance detail with the big picture. I started working more closely with Peter towards the end of my PhD, and at this time, my time was harder to manage. He went above and beyond in meeting me at times that minimized my stress and increased my joy. Both Bob and Peter were exemplary supervisors who were flexible and did what was best for their students. I would not be the researcher, nor would I be the human being I am today without their guidance, support and kindness.

The DAA is situated together with Dunlap, CITA and later The Centre for Planetary Sciences at UofT. Being part of this big astronomy community enriched my PhD experience. Beyond my interactions with my advisors, I learned so much from many other professors, postdocs, students, staff at the DAA, as well as visitors. I got help on all aspects of research, teaching, job searching and life. I would like to, in particular, point out the Dunlap Institute for the many conferences, teaching, outreach and leadership opportunities I was given.

Do you have any memorable moments you can share about your experience at DAA?

I have a myriad of memorable moments at the DAA. One joyful, encouraging and unexpected memory, like so many I have had at the DAA, was when the professor of a class I took told me that I was worth teaching when I felt I didn't perform as well as I should have. Memories like this, happening over and over again, made me feel like I belong as an astronomer and researcher in general.

What advice would you give to our students who are hoping to build a career in Astronomy?

Get to know yourself. This applies no matter what career you want to build, but people often underestimate its importance in having a fulfilling and useful life. I did this by making friends, trying new experiences and asking questions. Learn the best ways for you to learn about yourself. Learn under what conditions you are most happy, most productive, and most fulfilled. I learned that my happiness, self worth, and self identity are of utmost importance to protect, and that they should not depend solely on how my work is going. In fact, they should not depend on any single aspect of my life. I learned that I should not diminish my joy in teaching when my research is going badly, I learned that I should not depy myself love when my research is going badly. I learned that I should not deny myself love when my research is going badly. I learned that I should not deriving joy and wonder from other aspects of my life even when one aspect is going poorly, and that this is the only way I can build energy to work on the bad bits.

Featured Coming-Up Astronomy Events: Martin Scholarship Inaugural Lecture

Martin Scholarship is a very large and generous gift from the family of Prof. Peter Martin, who is a member of the Canadian Institute for Theoretical Astrophysics and an Officer of the Order of Canada. To celebrate this generous gift, we hosted the inaugural lecture given this year by Prof. Martin John Rees, Baron Rees of Ludlow.



Lord Martin Rees is a leading astrophysicist as well as a senior figure in UK science. He has conducted influential theoretical work on subjects as diverse as black hole formation and extragalactic radio sources and provided key evidence to contradict the Steady State theory of the evolution of the Universe. He is also one of the first to predict the uneven distribution of matter in the Universe and proposed observational tests to determine the clustering of stars and galaxies. Much of his most valuable research has focused on the end of the so-called cosmic dark ages — a period shortly after the Big Bang when the Universe was as yet without light sources. Lord Martin Rees is a Fellow of Trinity College and Emeritus Professor of Cosmology and Astrophysics at the University of Cambridge and is an Astronomer Royal and Past President of the Royal Society. Lord Martin Rees is the author of seven books of popular science. After receiving a knighthood in 1992 for his services to science, he was elevated to the title of Baron Rees of Ludlow in 2005.

His public lecture focused on 'The World in 2050 – and beyond' and took place on September 30th at 6pm at the Isabel Bader Theatre Victoria University, 93 Charles St W, Toronto. Below is the abstract for the presentation.

Our Earth has existed for 45 million centuries, but this is the first when one species - ours - has the planet's future in its hands. Advances in biotechnology, cybertechnology, robotics, and artificial intelligence - if pursued and applied wisely - could empower us to boost the developing and developed world and overcome the threats humanity faces. But we must avoid dystopian risks. These are of two kinds: those stemming from our ever-heavier collective 'footprint' on the Earth and those enabled by technologies so powerful that even small groups, by error or design, can create a catastrophe that cascades globally. At the same time, further advances in space science

will allow humans to explore the solar system and beyond with robots and AI. But there is no "Planet B" if we do not care for our home planet.

Awards

Undergraduate Students



Shannon Vanderwourde is the recipient of the 2019 Maurice and Christine Clement Scholarship in Astronomy and Astrophysics. She has also been

named the recipient of the Gold Medal of the Royal Astronomical Society of Canada.

Jacob Taylor is the recipient of Smith Solis Research Scholarship in Astronomy and Astrophysics, awarded to a top student in the AST425Y Research Topics in

Astronomy & Astrophysics course on the basis of demonstrated excellence in the written report and oral presentation.



Graduate Students:

Our gradate students received too many awards to mention throughout the year. Some of these awards include the NSERC Vanier Canada Graduate Scholarship, NSERC Alexander Graham Bell Canada Graduate Scholarship, Ontario Trillium Scholarship, Connaught International Scholarship and the Faculty of Arts & Science Top Doctoral Scholarship. **Nolan Denman** is the latest Fieldus award winner which is given to a senior student for leadership in our Department. Nolan has helped mentor many students and is praised for his insight into astronomy and physics issues that he passed on to them. **Emily Deibert** is the recipient of the 2019 NSERC Vanier Canada Graduate Scholarship (CGS). The Vanier CGS program was established in 2008 to support Canada as a global centre of excellence in research and higher learning. Its recipients demonstrate leadership skills and a high standard of scholarly achievement in graduate studies in the social sciences and humanities, natural sciences and/or engineering and health.

Postdoctoral Fellows Awards

Congratulations to the Dunlap Institute postdoctoral fellow **Jason Hunt** for being awarded the Polanyi Prize for his work on mapping our galaxy with the Gaia telescope.

Faculty Awards



Professor Jo Bovy has received the very

prestigious **2019 Vera Rubin Early Career Prize** for his work on the structure and dynamics of the Milky Way galaxy. He also received **the Helen B**. **Warner Prize** "for a significant early-career contribution to observational or theoretical astronomy, specifically for his contributions to our understanding of the structure and dynamics of the Milky Way and his work on forward modeling of large scientific data sets." The Warner Prize is the major early career prize in astronomy and astrophysics in North America. The Canada Council for Arts Killam Fellowships has been established to support outstanding scholars and to carry out their ground-breaking projects in the humanities, social sciences, natural sciences, health sciences, engineering and interdisciplinary studies within these fields. This year one of the six Killam Research Fellowships was awarded to own **Professor Marten van Kerkwijk** for his project called "Probing Extreme (Astro)Physics with Neutron Stars".





Professor Bryan Gaensler was named the recipient of the 2019 Peter Martin award for Mid-Career Achievement. The Award was established in 2009 upon a gift by Peter G. Martin, Past-President of the Canadian Astronomical Society and Professor at the University of Toronto and is awarded to a Canadian astronomer, or astronomer working in Canada, within ten to twenty years of receipt of his or her PhD degree, to recognize significant contributions to astronomical research.

Professor Maria Drout won a prestigious **2018 Azrieli Global Scholar Award** from the Canadian Institute for Advanced Research (CIFAR). This award aims at recognizing researchers from diverse fields in the early stages of their careers. Maria is one of 12 award winners in 2018 from Canada, the U.S., Israel, Singapore and the Netherlands.



Professor Renee Hlozek was named a CIFAR Azrieli Global Scholar. The Azrieli Globar Scholar is



recognition and support for young emerging leaders. Renee will join the Gravity and Extreme Universe program of CIFAR.

Professor Ue-Li Pen was named as one of the winners of the **2020 Breakthrough Prize in Fundamental Physics**, awarded to the Event Horizon Team for the making the first direct image of a black hole.



Congratulations on these achievements!

Major Research Achievements

Please see below the list of major research achievements from our Department as highlighted by the U f T News since the last issue of our newsletter.

 U of T astrophysicist Ue-Li Pen on first-ever image of a black hole and the international collaboration behind it

<u>https://www.utoronto.ca/news/u-t-astrophysicist-ue-li-pen-first-ever-image-black-hole-and-international-collaboration-behind</u>

- Researchers from U of T and other universities detect repeating fast radio burst <u>https://www.utoronto.ca/news/researchers-u-t-and-other-universities-detect-repeating-fast-radio-burst</u>
- U of T graduate student Matt Young probes the beginning of the universe from the bottom of the world

<u>https://www.utoronto.ca/news/u-t-graduate-student-matt-young-probes-beginning-</u> <u>universe-bottom-world</u>

U of T astronomers discover sonic boom from powerful unseen explosion

<u>https://www.utoronto.ca/news/u-t-astronomers-discover-sonic-boom-powerful-unseen-explosion</u>

✤ A 10-year anniversary, a 100-year conversation: the Dunlap gifts to astronomy:

https://boundless.utoronto.ca/news/a-10-year-anniversary-a-100-year-conversationthe-dunlap-gifts-to-astronomy/

Bringing Indigenous Knowledges in astronomy to the forefront

https://thevarsity.ca/2019/03/24/bringing-indigenous-knowledges-in-astronomy-tothe-forefront/

Our Archives: Clarence A. Chant's eclipse trip to Australia in 1922

by Lee Robbins

In late June, I met with Ernie Seaquist (past Chair of the Department and Director of the David



Dunlap Observatory (DDO), 1998-1993 and 1994-1999) who passed along a box of material to me from Don Fernie (also past Chair of the Department and Director of DDO, 1978-1988 and 1993-94). In the box were assorted papers and articles and a small brown wood box. The box contained a collection of lantern slides from Clarence A. Chant (past Chair, 1905-1935) documenting his eclipse trip to Australia in 1922 to test and confirm Einstein's theory of relativity. Included is Chant's handwritten catalogue of the slides. What a find!!!

Chant's lantern slides give a detailed personal account of the eclipse trip to Australia. The collection of slides includes pictures of the members of the eclipse expedition including "Mrs Chant" and "Miss Chant", R.K. Young (past Chair and Director of DDO, 1935-1945), the

Canadian "Einstein" camera, and the camp and tents occupied by the Canadian Party. There are also several slides of the local aboriginal community.

Chant participated in five total solar-eclipse expeditions, the most important being the one he led to Australia 1922 to test Einstein's theory of the deflection of starlight by a massive body.

The Chant lantern slides are now part of the collection at the University of Toronto Archive.

The official report on Chant's exposition: Evidence of the bending of the rays of light on passing the Sun, obtained by the Canadian Expedition to Observe the Australia Eclipse by Chant, C.A. & Young, R.K., 1923, PDAO, 2, 275.

Further reading: The eclipse Camp at Wallal, Chant, C.A. 1923, JRASC, 17, 1; The Canadian Eclipse Expedition: The Measurement of Einstein's Plates, Young, R.K., 1923, JRASC, 17, 129

Donald A. MacRae (1916-2006): An Under-Recognized Canadian Astronomer



We also would like to bring your attention to the excellent tribute to Professor Donald A. MacRae written by Professor John Percy. Donald A. MacRae was Chair of our Department and Director of the David Dunlap Observatory, and a leader in the Canadian astronomical community. Donald A. MacRae made several very important contributions to astronomy in Canada. He published multiple articles and contributed to several successful projects in the areas of Radio Astronomy and Lunar Science. Among them is the award-winning development of Very Long Baseline Interferometry (VLBI). Donald A. MacRae ensured that our department was well represented on the Canadian National Research Council's Associate Committee for Space Research. He was a member of the Board of

Trustees of the U.S. Universities Space Research Corporation, serving as Chair in 1973, and was a member of the Lunar and Planetary Institute in Houston.

Further reading: Donald A. MacRae (1916-2006): An Under-Recognized Canadian Astronomer, John R. Percy, 2019, JRASC, 113, 171.