Canadian Institute for Theoretical Astrophysics

2022 In Review

Letter from the Director

I hope this message finds you and your family healthy and safe. During the last year, I have continued to get to know and appreciate all of you, both in Toronto and across Canada and the world! I have called upon you to help CITA with its mission and will continue to do so in the future. Since our last "Year In Review" our world has changed in both very positive and very negative ways. We have lost CITAzens – early career and veteran alike. Armed conflicts roil the world and prevent untold numbers from achieving their potential. Our community perseveres in facing the challenges of COVID-19, and to all of you that continue to suffer, we are here for you! We have also had major scientific and creative breakthroughs within our community: honors, awards, new unions, and new beings have come forth at CITA! We welcome and celebrate you all!

The role of the theorist is to *dream*. We are often not the ones turning the knobs at the inspiring experiments and marvels of modern engineering. Our work begins well before any metal is cut or any laser beams are turned on. Our mission is Possibility. Inspiration cannot be called up at will or managed with charts and timetables. In that spirit, I invite you to consider the time-management wisdom of famed physicist Leo Szilard, who, struggling with his challenging PhD project from Max von Laue in a cold Berlin winter, remarked: "I couldn't make any headway with it! As a matter of fact, I was not even convinced that this was a problem that could be solved! And I thought Christmas time is not a time to work, it is a time to loaf! So I thought I would just think whatever comes to my mind!" And he did – particularly during long winter walks. Szilard's "loafing" led to the foundation of modern information theory. May your loafing be creative, and may you remember that, deep down, you, like Szilard and Dickinson, and all theorists "dwell in possibility." Happy Holidays!

I dwell in Possibility – A fairer House than Prose – More numerous of Windows – Superior – for Doors –

Of Chambers as the Cedars – Impregnable of eye – And for an everlasting Roof The Gambrels of the Sky –

Of Visitors – the fairest – For Occupation – This – The spreading wide my narrow Hands To gather Paradise –

— Emily Dickinson



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Top to bottom: CITA PDFs on their Canoe Trip (credit: Neige Frankel); Prof. Yin-Zhe Ma elected to the Academy of Science of South Africa (credit: Yin-Zhe Ma); Linda Strubbe and participants at the Pan-African School for Emerging Astronomers (PASEA) in Livingstone, Zambia, in October 2022 (credit: Linda Strubbe).







Welcoming New CITAzens

CITA's primary missions are to foster interaction within the Canadian theoretical astrophysics community and to serve as an international centre of excellence for theoretical studies in astrophysics. CITA has opportunities for people at all stages of their research careers from undergraduate summer students, to PhD students, and Post-Doctoral researchers. Through the CITA National Fellows Program, CITA also supports astrophysics research at universities across Canada.

New Faculty

CITA is welcoming three new faculty this year, a first in our history. This is an exciting moment for us as our new faculty broaden the expertise at CITA and expand the work that we do. From gravitational wave astronomy and cosmology to plasma physics, these three CITAzens are asking new questions about the universe and discovering novel ways to answer them. Welcome Profs. Maya Fischbach, Bart Ripperda, and Reed Essick! Read their full profiles on pages 8-10.

New Postdoctoral Fellows

Fellows carry out original research in theoretical astrophysics under the general supervision of the permanent faculty whose interests include: astrophysical dynamics, early universe, physical cosmology, interstellar and intergalactic matter, plasma physics and compact objects, galaxy, star, black hole and planet formation, stellar physics, high energy astrophysics and gravitational waves. CITA welcomed the following PDFs in September: Ioana Zelko, Claire Ye, Xiaohan Wu, Haunging Chen, Rimpei Chiba, and Sean Ressler.

As part of its mandate to promote research throughout Canada, the Institute provides support for postdoctoral fellows working in theoretical astrophysics or closely related fields at Canadian universities other than the University of Toronto, through the CITA National Fellowship Program. We're pleased to welcome our newest National Fellows: Connor Stone, Yayaati Chachan, Heather Fong, and Luciano Combi.

New Members of CITA Inc.

Our CITA Inc. membership is over 100 faculty spanning Canadian Universities as well as Canadians abroad. This year, we welcomed the following individuals into CITA Inc.: Gurtina Besla (University of Arizona), Jo Bovy (University of Toronto), Joseph Bramante (Queen's University), Evan McDonough (University of Winnipeg), Jess McIver (University of British Columbia), Sara Seager (MIT), Aaron Vincent (Queens), David Hogg (NYU), Vicky Kaspi (McGill). "Having experienced the prospering of CITA over four decades, it's exciting to recognize the present vibrancy as a harbinger of great promise as we work collectively on shared visions for the future."

Prof. Peter Martin CITA Interim Associate Director and Founding Director



CITA News

GAIA Hike 2022

After the third data release of the Gaia Space Mission, CITA organized the Gaia Hike workshop. This Canadawide event, hosted at the University of British Columbia, consisted of an unconventional workshop aiming to boost long-term national collaborations on Gaia-related science. The workshop lasted for an entire week of collective brainstorming, project design, and collaborative hacking of the newly released data. The format was constructed as an analogy to a hike: the ~40 attendees brainstormed ideas and produced a road map of projects, then started hacking on a well-marked trail with tutorials, and finished going off trail, in the wild, with research, plotting and coding. And yes, there was an actual inspirational hike in the middle of the week for all these hackers to get new ideas from the Chief in Squamish. The Gaia Hike was initiated by CITA postdoc Neige Frankel, who co-organized it together with Aarya Patil, David W. Hogg, Brett Gladman, Juna Kollmeier, Hans-Walter Rix, Julio Navarro, Ted Mackereth, Chris Hayes, Alan McConnachie, and Jeremy Heyl.

Postdoctoral Coding Advance

In March, a dozen CITA postdocs traded the greyness of Toronto's winter for Blue Mountain's snowy slopes, gathering for three days of collaborative work and coding. This event was dubbed the CITA Postdoc Coding Advance ("because at CITA, we don't retreat!!!" quipped Juna Kollmeier). The postdocs spent their mornings working together, learning how to produce python packages, compile C code, and run jobs on the CITA server. In the afternoons, they took in the fresh air while hiking, skiing, snowshoeing, and geek-talking on the ski lifts. Thank you to postdocs Neige Frankel and Phil Landry for organizing!

2022 Jamboree

CITA held its annual National Jamboree on October 4th, organized by CITA postdocs Zack Li and Dongwoo Chung. This year's Jamboree carried over the national hybrid format from last year, but combined it with the conventional pure-rapid-fire format of previous Jamborees. The Jamboree showcased Canadian astrophysics research happening from coast to coast, with 39 presenters from not just Toronto but also other Canadian institutions including Queen's University, the University of Calgary, and the University of British Columbia. Attendees and presenters came away with a great sense of the community encompassing all of the students, postdocs, and faculty that drive CITA science, from the dynamics of compact objects to the earliest moments of cosmic history! Thank you to everyone who participated and keep your eyes out for an announcement of the 2023 Jamboree.

CITAthlon

CITA inaugurated its first multisport day in May! The event (initiated by postdoc N. Frankel), named CITAthlon, consisted in building a team of CITAthletes to travel together the longest cumulative distance they can, over various means of travel: biking (12km), running (3km), canoeing (1h). They also planned to run more and add in some swimming, but the plan was a bit too ambitious. Perhaps next year now that they are trained! The CITAthlon team members were: Neige Frankel, Norm Murray, John Dubinski, Rainer Weinberger, Martine Lokken, Phil Landry, Nate Carlson, and Fei Li. Together they covered over 100km and set a first performance record to beat over the next years. The team is looking to recruit more athletes. They found the event truly memorable and so fun that they repeated it on the following Saturday. "I had a great time crashing on the grass downhill!" said Murray.

CITA Planet Day

CITA welcomed astronomers from across Canada (virtually and in person!) for our annual Planet Day on August 9th. Participants discussed the latest challenges and opportunities in the field and forged new collaborations. Sessions included both invited and contributed talks and covered dynamics, protoplanetary disks, and planet detection. On August 10th, those gathered in Toronto had a group canoeing day at the harbourfront! Thank you to CITA PDFs JJ Zanazzi (now a 51 Peg B fellow at UC Berkeley) and Sam Hadden for organizing this event.

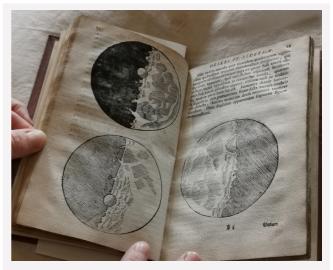
Scintillometry Workshop

CITA hosted a 5-day Scintillometry workshop in August in partnership with the Dunlap Institute. This workshop has proven to be useful to early-career researchers, in gathering top experts to discuss the current landscape of the field. New results were showcased, and talks highlighted the current big questions of the field, and the capabilities of the new telescope facilities were demonstrated. Thank you to Prof. Ue-Li Pen and the local organizing committee.

Jennifer Y. H. Chan: Dispatches from London

I gave my thesis prize talk (2020 Michael Penston Prize) at the UK Royal Astronomical Society Ordinary (RAS) Meeting in October. It was held in hybrid, with roughly ~50 people attending in-person and 70 people joining online. It was great fun interacting with such a wide group of audiences of diverse backgrounds (undergrads, postgrads, academics and serious amateur astronomers, with disciplines ranging from maths, solid-Earth geophysics to cosmology), and I was so grateful for being able to make it in-person.

Another highlight was visiting the RAS library to see some of the treasures in the collection, such as the glass photographic plates of the 1919 Solar Eclipse that verified General Relativity, records of the Carrington Event (history's greatest solar storm recorded), the book of Dialogo di Galileo Galilei Linceo (Dialogue Concerning the Two Chief World Systems), and the book of Sidereus Nuncius (Starry Messenger).



Starry Messenger, Sidereus Nuncius. Photo by Jennifer Y. H. Chan.

2022 CITA Canoe Trip

In October a group of CITA graduate students and postdocs arranged a weekend canoe trip to Algonquin Provincial Park. The group of six paddled 12km into the Algonquin backcountry and camped for one night in the park. The weekend's science activities included reading and discussing papers around the campfire, practicing elevator pitches, and more in-depth talks about our research as we paddled, observing the night sky unhindered by city lights, and looking for analogies to our research in nature. The CITA Canoe Trip was organized by Nathan Carlson with help and input from the full team of attendees: Huanqing Chen, Neige Frankel, Shivan Khullar, Phil Landry, and Rainer Weinberger.

Collaboratory: ETA Spring 2023

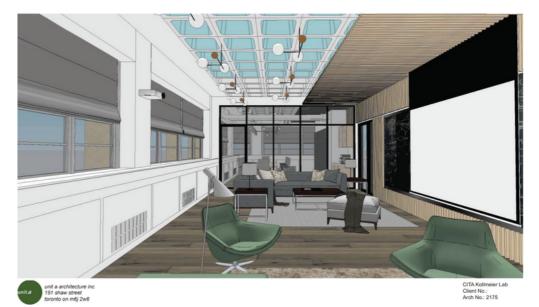
We're excited to share an update on the CITA Collaboratory, which is being built in the old library on the 13th floor of McLennan.

The proposed new CITA Collaboratory will provide a welcoming new gathering space for the Institute to host both local and external events. On a day to day basis, the space will accommodate faculty, research associates, postdoctoral fellows, and graduate students. With expansive views of the city, an open floor plan, and high ceilings, this space lends itself to this exciting vision of a new central gathering space for the Canadian Institute for Theoretical Astrophysics.

The Collaboratory will include both a meeting room for 10 with video wall and integrated AV technology, an informal meeting space with a range of touch down points for both formal and informal discussion and, most importantly, lots of blackboards!

The CITA Collaboratory is scheduled for completion in Spring 2023.













2022 CITA Events

Thanks to all who submitted photos

Getting together to share ideas, questions, joys, and challenges is one of the greatest parts of CITA. We know that scientific breakthroughs take inspiration and challenge from one another, and so we reach out and gather for brainstorming, learning, and mentorship. This year, CITAzens gathered in groups of all sizes, all over the country. From reigniting focus groups to reading papers around a campfire, there's no bad place to explore our science.











New Faculty Profiles

What are the histories of black holes? Introducing Prof. Maya Fishbach

Ever try piecing together a conversation you only caught the last few words of? How about reconstructing a billion year history based on only the last few seconds of data? This is one of the pillars of Prof. Maya Fishbach's work, reconstructing the histories of merging black holes by observing their gravitational waves. Through a combination of data analysis and theoretical modeling, her research strives to explain how, where, and when black holes and neutron stars form and merge.

Fishbach started her PhD the same month that gravitational waves were first detected, setting her PhD work against the backdrop of that first data set. Fishbach developed methods to analyze the first 11 gravitational-wave events, including how to combine the data from multiple events to learn about the population of black holes and neutron stars. Now with data collected from almost 100 events. Fishbach is part of a small but rapidly growing community of gravitational wave astronomers who are using this new tool to observe the universe. In the next five years, Fishbach hopes to see gravitational wave astronomy become mainstream - just another tool that astronomers use and engrained in how we study the universe.

Fishbach was a NASA Hubble Fellowship Program Einstein Postdoctoral Fellow at Northwestern University in 2020-2022, where she collaborated with Prof. Vicky Kalogera's group. She completed her PhD at the University of Chicago (2020) under the advisory of Prof. Daniel Holz and her BS at Yale University (2015).



Research Highlights:

- The discovery of missing big black holes in the black hole mass spectrum, which probes the physics of pair-instability supernovae (Fishbach & Holz 2017)
- Evidence that the black hole merger rate evolves with redshift (Fishbach et al. 2018)
- The first gravitational-wave measurement of the Hubble constant from combining gravitational waves and a galaxy catalog (Fishbach et al. 2019)

"Not your typical Astrophysicist": Introducing Prof. Bart Ripperda

Love what you do and you'll never work a day in your life. This is how Prof. Bart Ripperda feels about black holes. Ripperda describes himself as "not your typical astrophysicist," coming to the field by way of plasma physics. In his work, he combines fundamental plasma physics to understand astrophysical phenomena. He is excited by the most extreme places in the universe: the places that we don't understand.

Ripperda's approach is grounded in creativity. He is trying to model, understand, and predict multimessenger signals and multiwavelength emissions from black hole and neutron star jets, coronae, accretion disks, and magnetospheres with a combination of theoretical and numerical (general) relativistic kinetic and fluid methods. Creative thinking is what keeps Ripperda excited in this work every day.

Ripperda is drawn to enigmatic things, hence his interest in black holes. His interest starts where our understanding breaks. Physics around black holes requires many ingredients – general relativity, quantum mechanics, and an understanding of the dynamics of a billion different particles are necessary in order to understand that which we cannot see.

Ripperda comes to CITA from the Institute for Advanced Study, Princeton, where he is a NASA Hubble Fellowship Program Einstein Fellow. Previously, he was a joint postdoctoral fellow at the Flatiron Institute in New York City and at Princeton University. Ripperda received his PhD in Mathematics from KU Leuven University in 2018, under the advisory of Prof. Rony Keppens, MScs in Physics and Engineering, both from Eindhoven University of Technology (2013), and his BSc in Engineering, also from Eindhoven University of Technology (2009).



Research Highlights:

- Understanding how magnetic reconnection at black hole event horizons can produce flaring hot spots orbiting Sgr A* as observed by the GRAVITY interferometer (Ripperda, Bacchini, Philippov, ApJ, 2020; Ripperda, Liska, Chatterjee, et al., ApJL, 2022)
- The discovery of a mechanism that can power the very-high-energy (TeV) flares from the event horizon of supermassive black holes based on a model including all first-principles physics from quantum electrodynamics to general relativity (Hakobyan, Ripperda, Philippov, ApJL, 2022)
- Finding magnetic reconnection sites in plasma turbulence that can dissipate a large fraction of magnetic energy to potentially power emission from black hole accretion disks and coronae, with extreme resolution simulations (Ripperda, et al, JPP, 2021; Chernoglazov, Ripperda, Philippov, ApJL, 2021)

Interested in understanding everything? Introducing Prof. Reed Essick

An advisor once told Prof. Reed Essick that he seemed interested in understanding everything, and that you have to understand a bit of everything to do Astrophysics. Essick has never looked back. With his focus on questions at the heart of the field, it's easy to see that he found the right fit.

What physics can we explore with neutron stars? How do neutron stars fit into the broader picture of the universe? What is their relationship to black holes? How can we explore connections between theoretical calculations, nuclear experiments, and astrophysical observations?

Essick knows there is no one perfect system that will answer all our questions. He sees the field moving towards using many systems, multimessenger signals, and data from different channels to approach an understanding of that which we do not know. Essick credits his PhD advisors, Dr. Erik Katsavounidis and Prof. Nevin N. Weinberg, for teaching him how to ask interesting questions and do calculations to the level of excellence that CITA is known for.

Essick studies many aspects of experimental gravity, from data acquisition, quality, and calibration to searches for astrophysical signals and their interpretation. Most recently, he has used neutron stars to study multiple pillars of modern physics: nuclear physics and strong gravity.

Essick held postdoctoral fellowships at the Perimeter Institute for Theoretical Physics (2021-2022) and the Kavli Institute for Cosmological Physics, University of Chicago (2017-2021). He earned his PhD from the Massachusetts Institute of Technology (2017) and his BS in Mechanical Engineering with a second major in Physics from Washington University in St. Louis (2011).



Research Highlights:

- Played a key part in many breakthrough discoveries within the LIGO Scientific Collaboration (LSC). He was often one of the first people to see the data from new detections, including the first ever direct detection of gravitational waves (GW150914 [PRL 116, 061102]) and the first ever detection of gravitational waves from coalescing binary neutron stars (GW170817 [PRL 119, 161101]). Essick even sent the first email announcing GW170817 to electromagnetic observers in lowlatency.
- Shed light on effective nuclear interactions and the connections between terrestrial experiments and astrophysical observations [PRC 102, 055803 (2020), PRL 127, 192701 (2021)] with his work combining ab initio nuclear theory calculations with model-agnostic astrophysical constraints.

Publications

CITAzens publish hundreds of papers every year. Covering topics from gravitational waves to the early universe to popular science, these works collectively introduce big ideas, new solutions, and developments in theoretical astrophysics to diverse audiences. The following is a small selection of what has come out in the last year. Amplifying your work is important to us. Please let us know about any forthcoming publications that you would like us to share.

Ioana Zelko, CITA, University of Toronto

The nature of dark matter is one of the most important unsolved questions in science. Some dark matter candidates do not have sufficient non-gravitational interactions to be probed in laboratory or accelerator experiments; it is thus important to develop astrophysical probes which can constrain or lead to a discovery of such candidates. I use state-of-the-art measurements of strong gravitationally-lensed quasars to constrain four of the most popular sterile neutrino models, and also report the constraints from other independent methods that are comparable in procedure.

Zelko, I. A., Treu, T., Abazajian, K. N., Gilman, D., Benson, A. J., Birrer, S., Nierenberg, A. M., & Kusenko, A. (2022), *Physical Review Letters*, 129, 19.

Levon Pogosian, Simon Fraser University

Prof. Pogosian's collaborators and himself used the latest cosmological data to reconstruct the redshift evolution of three functions describing the expansion history of the Universe and gravitational effects on light and matter in the large-scale structure. This was the first time the three functions were reconstructed simultaneously, allowing to test validity of General Relativity on cosmological scale. They checked if late-time modifications of gravity can help resolve some of the cosmological tensions, and the short answer is "<u>unlikely</u>".

Pogosian, L., Raveri, M., Koyama, K. et al. Imprints of cosmological tensions in reconstructed gravity. <u>*Nature Astronomy*</u> (2022).

Doug Johnstone, Herzberg Astronomy & Astrophysics, National Research Council Canada

UVic graduate student Logan Francis (now a post-doc in Leiden), Doug Johnstone, and the JCMT Transient team used the JCMT and ALMA to probe the physical structure of the envelope surrounding of a protostar, EC53, via accretion burst echoes.

Francis, Logan, Johnstone, Doug, et al. 2022, The Astrophysical Journal, 937, 29.

UVic graduate students Dori Blakely, Logan Francis, along with Doug Johnstone, and a team of optical interferometry experts analyzed sparse aperture masking observations of the young star LkCa15 and identified two rings and an inner disk. The paper introduces a new investigative method that will be used with up-coming GTO JWST NIRISS observations of transition disks.

Blakely, Dori, Francis, Logan, Johnstone, Doug, et al. 2022, The Astrophysical Journal, 931, 3.

Doug Johnstone, with five other star formation experts wrote a review "Accretion Variability as a Guide to Stellar Mass Assembly" for the up-coming Protostars and Planets VII conference to be held in Japan in April 2023.

Fischer, William J., Hillenbrand, Lynne A., Herczeg, Gregory J., Johnstone, Doug, Kóspál, Ágnes, & Dunham, Michael M. 2022, arXiv e-prints.

"I have made professional connections and learned about topics that would otherwise have passed me by."

> Prof. Robert Brandenberger Former CITA Council Chair

AAS | IOP Astronomy

Great Mysteries in Astrophysics A guide to what we don't know

Nicole M Lloyd-Ronning



Simon Foreman, Arizona State University

A group of four former CITA postdocs (and one faculty member) examined the prospects for "mapping the universe in HD," i.e. doing line intensity mapping with rotational transitions in the hydrogen deuteride molecule. The resulting paper in Physical Review D was chosen as an editor's suggestion and featured in Physics Magazine.

Breysse, P. C., Foreman, S., Keating, L. C., Meyers, J., & Murray, N. (2022). Mapping the Universe in hydrogen deuteride. Physical Review D, 105, 8.

Denis Leahy, University of Calgary

Prof. Leahy published <u>several papers</u> on the analysis of AstroSat observations of M31, looking into star formation history and galactic structure.

Leahy, D. A., Postma, J. E., Buick, M., Leahy, C., & Craiciu, T. (2022). New views in the ultraviolet of the Andromeda galaxy enabled by the AstroSAT/UVIT Telescope. In J.-W. A. den Herder, S. Nikzad, & K. Nakazawa (Eds.). Society of Photo-Optical Instrumentation Engineers (SPIE) Conference Series, vol. 12181, e121813I.

Leahy, D., Buick, M., & Leahy, C. (2022). AstroSat/UVIT Cluster Photometry in the Northern Disk of M31. \aj, 164, 5, e183.

Leahy, D., Seminoff, N., & Leahy, C. (2022). Far-ultraviolet to FIR Spectral-energy Distribution Modeling of the Stellar Formation History of the M31 Bulge. \aj, 16, 3, e138.

CITAzen Library

Nicole Lloyd-Ronning: Great Mysteries in Astrophysics: a guide to what we don't know

This popular science book explores gaps in the current research about the universe. ISBN: 9780750340519

Prof. Gary Felder: Modern Physics

New textbook for sophomore level introduction to Modern Physics. ISBN: 9781108842891

Prof. Barbara Ryden: Stellar Structure and Evolution

Graduate/advanced undergraduate textbook co-written with Marc Pinsonneault. Available August 2023. ISBN: 9781108798822

Phase Transitions

Simon Foreman

Dr. Foreman will be starting a faculty position in Department of Physics at Arizona State University in January 2023.

Dan Tamayo

Dr. Tamayo started a faculty job at Harvey Mudd College.

Gillian Wilson

Dr. Wilson was hired into a new administrative leadership position as Vice Chancellor for Research, Innovation and Economic Development at the University of California Merced. She is also undergoing the process of being hired as a faculty member in the Physics Department. In 2021, Dr. Wilson was elected a Fellow of the American Physical Society (APS).

Visweshwar Ram Marthi

Dr. Marthi obtained tenure at the National Centre for Radio Astrophysics, Tata Institute of Fundamental Research.

Carl-Johan Haster

Dr. Haster joined the University of Nevada, Las Vegas (and its newly formed Nevada Center for Astrophysics) as an Assistant Professor.

Rainer Weinberger

Dr. Weinberger will be joining Leibniz Institute for Astrophysics Potsdam (AIP) in 2023 as a Leibniz junior group leader.

Doug Johnstone

Dr. Johnstone was appointed to a two-year position as President's Science Advisor & Secretary to President's Research Excellence Advisory Committee at the National Research Council Canada.

Linda Strubbe

Dr. Strubbe is now working as a freelance Educational Consultant in physics and astronomy higher education. Her consulting work includes professional development in teaching, equity, and inclusion, external evaluation, workshops, and curriculum design.

Tarun Souradeep

Dr. Souradeep began as Director of the Raman Research Institute in Bengaluru, India.

Laura Keating

Dr. Keating was awarded the inaugural Elizabeth Gardner fellowship at the School of Physics and Astronomy, University of Edinburgh.

Dr. Michael West spent February and March 2022 in Finland, where he taught a course on Communicating Science with the Public at the University of Turku and researched culture's role in science communication.

Below, Dr. West stands against a backdrop of Northern Lights.



Awards, Honours, and Accolades

Awards and accolades shine light on the significant impact that CITA researchers and alumni have both in the field and in the world at large. The work that is done all over the world by CITAzens lays the groundwork for important developments across the sciences. We are fortunate to count our members as the greatest minds and talents both in theoretical astrophysics and in the many other fields in which our alumni work. Please join us in congratulating fellow CITAzens on these achievements.

Yanqin Wu, University of Toronto

Prof. Wu was awarded the Guggeiheim Fellowship 2022 for her proposal on studying the 'segemented disks'.

Henk Hoekstra, Leiden Observatory

Prof. Hoekstra was awarded an Advanced Grant from the European Research Council to support the scientific analysis of upcoming Euclid data.

Yin-Zhe Ma, University of KwaZulu-Natal, South Africa

Prof. Ma was elected to the <u>Academy of Science of South Africa</u>. This membership of the Academy marks the top scholar in South Africa. The Academy of Science of South Africa (ASSAf) is the national Academy of South Africa, established by its first democratic president, Nobel Peace Prize Laureate Nelson Mandela in 1996, which aims to strengthen science in the new-formed democratic country.

Michael West, Lowell Observatory

Dr. West was selected as a 2021-2023 U.S. Fulbright Scholar.

Nicole Lloyd-Ronning, Los Alamos National Lab & University of New Mexico, Los Alamos

Dr. Lloyd-Ronning was named an <u>American Physical Society Fellow</u> in 2022.

Simon Blouin, University of Victoria

Dr. Blouin received a 2021 Postdoc Distinguished Performance Award from Los Alamos National Laboratory for his work on advanced computer simulation techniques to develop improved models of the constitutive physics of white dwarfs. This award recognizes contributions towards outstanding and unique research resulting in a positive, significant impact.

Dongwo Chung, CITA, University of Toronto

Dr. Chung is the recipient of the 2022 Beatrice and Vincent Tremaine Fellowship, which is given annually in memory of Beatrice D. and Vincent J. Tremaine to honour their lifelong interest in mathematics, science, and learning.

Ue-Li Pen, CITA, University of Toronto

Prof. Pen was named a Fellow of the <u>Royal Society of Canada</u> and collaborated on CHIME, which won the Brockhouse Canada Prize.

Juna A. Kollmeier, CITA, University of Toronto

Prof. Kollmeier was selected as the 2022 Jacques Solvay International Chair in Physics. As part of this award, she did a residency in Brussels, where she delivered a series of lectures on her research.

Jennifer Y. H. Chan, CITA and Dunlap, University of Toronto

Dr. Chan gave her thesis prize talk (2020 Michael Penston Prize) at the <u>UK Royal Astronomical Society</u> Ordinary Meeting in October. See the full story on page 5.

Thiem Hoang, Korea Astronomy and Space Science Institute/Korea University of Science and Technology

Dr. Hoang was awarded the 2022 Academic Award from the Korean Astronomical Society for his outstanding contribution to the development of Korean Astronomy through making world-class research achievements on the alignment of interstellar dust, the origin of magnetic fields in outer space, and the search for extraterrestrial life.

Alumni Updates

It is CITA's privilege to witness the accomplishments and celebratory moments of our alumni, as well as their challenges. We are reminded that CITA is not just one moment in our lives and careers. It is our cheerleader, our sounding board, the place, both physical and virtual, where questions and ideas grow. For those joys not shared, we celebrate with you, and for those challenges not voiced, we hold you in our thoughts.

Derek Richardson, University of Maryland

Prof. Richardson reports the successful impact of the <u>NASA DART</u> spacecraft with its target asteroid,
Dimorphos (moon of asteroid Didymos), as a first test at scale of a kinetic impactor as a strategy for
mitigating collision hazards with Earth. The roughly 12-hour orbital period of the moon was reduced by about
30 minutes, indicating ejecta from the impact provided an extra boost to the momentum transfer, as
expected. Richardson is a co-investigator for DART and lead of the dynamics working group for the mission.

Linda Strubbe, Strubbe Educational Consulting

Dr. Strubbe co-led the fifth Pan-African School for Emerging Astronomers (<u>PASEA</u>) in Livingstone, Zambia, in October 2022. They had a successful program with ~40 university students from 13 countries across Africa, who learned an introduction to astronomy through inquiry-based labs, interactive lessons, and discussions. Dr. Strubbe is the Co-Director for PASEA, which she started while a postdoc at CITA.

Peter Barnes, Space Science Institute

Dr. Barnes reports a number of exciting developments in his research. The year started with submission of a large magnetic field study of the massive molecular cloud BYF73, based on Cycle 7 SOFIA+ALMA data. This was followed by an observing trip to New Zealand in June, for several flights aboard SOFIA for further magnetic field mapping of star-forming clouds with the HAWC+ instrument. During this trip, a major NSF grant was awarded to support the ThrUMMS and related surveys of the molecular Milky Way. In August, DR1– 5 of his CHaMP project were ported to NASA's InfraRed Science Archive for community access. Throughout the year, Barnes co-authored several papers with the SEDIGISM consortium. The year will conclude with continuing the magnetic field studies (including acceptance of the BYF73 paper), ramping up the ThrUMMS work, and presenting the BYF73 results at AAS 241 in Seattle.

Per B. Lilje, University of Oslo

"The year 2022 started great, as my 5th grandchild was born at 5 am on the 1st of January. I am still head of the Institute of Theoretical Astrophysics of the University of Oslo, which I have been for 14 years."

Marta Reina-Campos, McMaster University

Dr. Reina-Campos celebrates the birth of her first son! Gabriel was born July 3rd as a chubby and healthy baby boy. They both recovered quickly and have been enjoying being outside this fall.

Visweshwar Ram Marthi, National Centre for Radio Astrophysics, Tata Institute of Fundamental Research

In order to exploit the full potential of the GMRT, along with a team of engineers, Prof. Marthi has enabled recording the full 100/200/400 MHz of baseband signals. The main intention behind this new facility is to enable Very Long Baseline Interferometry, or VLBI. VLBI also requires the signals to conform to certain bandwidths and sample rates, which necessitated implementing a full signal processing pipeline. Successful VLBI experiments have now been conducted with a few EVN telescopes, as well as Parkes and a few other Australian telescopes. The GMRT provides a sensitivity boost at intermediate baselines to the EVN and the Australian LBA, opening new avenues for VLBI in the Eastern hemisphere.

In Memoriam

Werner Israel (1931-2022)

Werner Israel died peacefully, surrounded by his family on the evening of May 18, 2022. Dr. Israel was an initial (charter) supporter of CITA and a leading member of the original CIFAR Cosmology and Gravity Program. He is remembered for his profound contributions to the field of gravitational physics and as a teacher and mentor to many. Dr. Israel was a joy to be around and is sadly missed.

Jing Luo (1987-2022)

Jing Luo passed away on February 15, 2022. Dr. Luo is fondly remembered and missed by all who knew him. As a Postdoctoral Fellow at CITA, he was a friend and mentor to many. Dr. Luo was known for being joyful, charismatic, and generous, alongside his deep love for astrophysics. In May, friends and colleagues from across the world gathered for a day in his memory. Jing's playful spirit and love of astrophysics underscored the "fun" in fundamental research. The Dr. Jing Luo Fun Fund has been set up to support students and postdocs to get together and have fun during their scientific journeys. We are grateful to Sheila Waengler for establishing this endowed fund to honour Dr. Luo.





Dr. Werner Israel raises a glass at a CIFAR event in 2007.



Dr. Jing Luo posing by the CITA van, with a bike on Toronto Island, in his famous cowboy hat in the snow, and in celebration.