# CaNPAN Jam 2024

# Report of Contributions

Contribution ID: **1** Type: **not specified**

# Nuclear Astrophysics Experimental Facilities at ISAC

*Thursday, 2 May 2024 09:00 (30 minutes)*

An overview of experimental nuclear physics facilities at ISAC. Aimed at the CaNPAN students, I'll provide a brief intro to the subject of measurement of nuclear observables relevant to astrophysics, before a virtual tour of the ISAC facilities and how they enable these measurements with exotic radioactive beams from the ISAC facility. In the afternoon, attendees will get to see the facilities first hand.

**Presenter:** RUIZ, Chris (TRIUMF)

**Session Classification:** Morning

Contribution ID: **2** Type: **not specified**

# Radiative Capture on a Nuclear Isomer: 26mAl(p,g)27Si

*Thursday, 2 May 2024 09:30 (20 minutes)*

"In explosive astrophysical environments, such as novae, supernovae and neutron star mergers, a significant fraction of atomic nuclei are expected to exist in excited quantum states. These elevated levels participate in nucleosynthesis much in the same way as nuclear ground states and, as such, play an essential role in determining the abundance of chemical elements in our Galaxy.

In this contribution, I present the first direct measurement of an astrophysical reaction using a radioactive beam of isomeric nuclei, performed with the DRAGON recoil separator at TRIUMF. In particular, we have measured the strength of the key 447-keV resonance in the 26mAl(p,γ)27Si reaction to be 432+146−226 meV and find that this resonance dominates the thermally averaged reaction rate for temperatures between 0.3 and 2.5 GK. This work represents a critical development in resolving one of the longest standing issues in nuclear astrophysics research, relating to the measurement of proton capture reactions on excited quantum levels, and offers unique insight into the destruction of isomeric 26Al in astrophysical plasmas."

**Presenter:** LENNARZ, Annika (TRIUMF)

**Session Classification:** Morning

Contribution ID: **3** Type: **not specified**

# 86Kr(α,n)89Sr and the weak r-process

*Thursday, 2 May 2024 09:50 (20 minutes)*

The r-process is responsible for half of all heavier-than-iron elements in the universe today. However, while models have been able to reproduce the abundance distributions of the heaviest elements observed in ultra-metal poor stars, intermediate-mass elements ($36 < Z < 47$) have been observed to be more abundant than expected from model predictions. The weak r-process in early core-collapse supernovae has been proposed as an additional source of intermediate-mass elements [1]. Significant uncertainties in abundance predictions from simulations of the weak r-process have their origins in the choice of the α-Optical Model Potential used in Hauser-Feshbach calculations for the cross section of (α,n) reactions. In order to reduce the uncertainties of model predictions for the weak r-process, it is necessary to measure the cross sections of (α,n) reactions on intermediate mass elements.

The cross section of the reaction 86Kr(α,n) 89Sr was identified as a priority to measure [2]. As such, a study has been conducted at the TRIUMF/ISAC facility using the EMMA recoil mass spectrometer and the TIGRESS gamma-ray spectrometer to do just that at energies relevant to the weak r-process. Partial cross sections from the 86Kr(α,n) 89Sr reaction shall be reported.

[1] Bliss et al. (2017) J. Phys. G: Nuclear. Part. Phys. 44 054003.

[2] Bliss et al. (2020) Phys. Rev. C. 101 055807.

**Presenter:** ANGUS, Cameron (TRIUMF)

**Session Classification:** Morning

Contribution ID: **4** Type: **not specified**

# (*R) The 22Ne(a,n) Reaction at DRAGON

*Thursday, 2 May 2024 10:10 (20 minutes)*

Almost half of the elements heavier than iron are believed to be produced in the r-process. It is now understood that one r-process sight is neutron star mergers. However, observations suggest the r-process must be occurring in addition sights. One possibility is core-collapse supernovae, which are predicted to be driven by the weak r-process, in which heavy elements are produced by a series of (α,n) reactions. A sensitivity study by Bliss et al. has identified several (α,n) reactions that significantly impact the production of lighter heavy elements in the weak r-process [1].
The DEMAND array has been developed to study such (α,n) reactions directly at DRAGON. This array consists of eight organic glass scintillator detectors. The DEMAND array was used to study the 22Ne(α,n)25Mg reaction as a proof-of-principle experiment. This reaction was selected as it is known to have several strong resonances [2], making it an ideal test case for this new technique. Preliminary results are presented in this talk, highlighting the detectors' excellent pulse shape discrimination capabilities and proving the feasibility of this new method.
[1] J. Bliss et al., Phys. Rev. C 101, 055807 (2020)
[2] M. Jaeger et al., Phys. Rev. Lett. 87, 20 (2001)

**Presenter:** REED, Ben (TRIUMF/SMU)

**Session Classification:** Morning

Contribution ID: **5** Type: **not specified**

# The 7Be(a,g) reaction and the neutrino-p process

*Thursday, 2 May 2024 11:00 (20 minutes)*

The nu-p process has been proposed to happen in the neutrino-driven winds of core-collapse supernovae, and its nucleosynthesis may help explain the origin of several p-process elements. This nucleosynthesis has been shown in reaction sensitivity studies to be affected by the 7Be(alpha, gamma)11C reaction rate. This presentation will discuss a measurement of 7Be(alpha, gamma) resonance strengths for the nu-p process, using the DRAGON recoil separator.

**Presenter:** CHEN, Alan (McMaster)

**Session Classification:** Morning

Contribution ID: **6** Type: **not specified**

# Commissioning of SHARC-II at EMMA to measure the impact of isomeric states in nova explosions

*Thursday, 2 May 2024 11:20 (20 minutes)*

Nuclear reactions play a pivotal role in the understanding of astrophysical phenomena, providing key insights into the processes occurring within stars, supernovae, and other celestial bodies. Especially experiments with radioactive isotope beams (RIB) in inverse kinematics are a vital tool to get direct information on cross-sections of astrophysical important nuclear reactions with quickly decaying or metastable isotopes. Since in inverse kinematics the heavy recoil is boosted forward in the direction of the unreacted beam, recoil mass spectrometers have emerged as valuable tools in the field of nuclear astrophysics with RIB. They allow precise measurements of reaction cross-sections and enable a deeper comprehension of the nuclear reactions essential for stellar nucleosynthesis.
The EMMA (Electro-Magnetic Mass Analyzer) recoil mass spectrometer, located at TRIUMF, is renowned for its unique design and exceptional performance. The presentation will highlight key features of EMMA and focus on the commissioning of the new target chamber SHARC-II. The new setup combines EMMA's unique advantages with prompt ejectile detection and the highly efficient gamma spectroscopy array TIGRESS. This way we can harness the full potential of RIB experiments and unravel the intricacies of stellar processes.

**Presenter:** Dr WAGNER, Louis (TRIUMF)

**Session Classification:** Morning

Contribution ID: **7** Type: **not specified**

# Bound-state beta-decay of 205Tl and its impact on s-process nucleosynthesis

*Thursday, 2 May 2024 11:40 (20 minutes)*

Lead-205 initially looks like a very promising candidate to be used as a chronometer for the early Solar System due to its unique position among astrophysically short-lived radionuclides as an s-only isotope probing the termination of the s process [1]. Unfortunately, the 2.3 keV 1/2− first excited state in 205Pb reduces the half-life in stellar environments by around 6 orders of magnitude, which could severely inhibit 205Pb production. However, Yokoi et. al. [2] pointed out that the bound-state β decay of 205Tl could counter- balance this decay by producing 205Pb. To clarify the complex production of 205Pb, we measured the bound-state β decay of 205Tl81+ at the Experimental Storage Ring in GSI, Darmstadt. From the measured half-life, we calculated new weak decay rates for a wide range of astrophysical conditions. AGB stellar nucleosynthesis models based on these new rates saw approximately a factor 2 increase in 205Pb production (when legacy rates were controlled). With new production ratios, we predicted an updated steady-state interstellar medium (ISM) 205Pb/204Pb ratio. By comparing the ISM ratio to the ratio measured in the earliest meteorites, we derived, for the first time, a positive time interval for the isolation period of the solar material from enrichment. Our new results are also consistent with other s-process chronometers.

**Presenter:** LECKENBY, Guy (TRIUMF)

**Session Classification:** Morning

Contribution ID: **8** Type: **not specified**

# Neutron Capture in Inverse Kinematics

*Thursday, 2 May 2024 13:00 (20 minutes)*

Virtually all of the isotopes heavier than iron would not exist without neutron-induced reactions. Despite there importance in many different astrophysical scenarios, there are almost no direct measurements for isotopes with half-lives shorter than a few years. A radically new approach is necessary to overcome this constraint.

Ion storage rings offer unprecedented possibilities to investigate radioactive isotopes of astrophysical importance in inverse kinematics. During the last years, a series of pioneering experiments proofed the feasibility of this concept for the fusion of charged paricles at the Experimental Storage Ring (ESR) at GSI. In the future, a combination of a free-neutron target and an ion storage ring can bring the half-life limit for direct neutron-induced reactions down to fractions of a minute.

I will review different astrophysical scenarios, status of current experiments as well as prospects of this new experimental endeavor.

**Presenter:** RENE, Reifarth (LANL)

**Session Classification:** Afternoon

Contribution ID: **9** Type: **not specified**

# Introduction & Opening Remarks

*Wednesday, 1 May 2024 09:00 (20 minutes)*

**Presenters:** LORIA, Mallory (University of Victoria/TRIUMF); CICCONE, Stephanie (University of Guelph)

**Session Classification:** Morning

Contribution ID: **10** Type: **not specified**

# Introduction to CaNPAN: Goals, Activities, Accomplishments and Future Plans

*Wednesday, 1 May 2024 09:20 (40 minutes)*

The Canadian Nuclear Physics for Astrophysics Network is bringing together the multiple disciplines needed to investigate the origin of the elements. The emphasis is on nuclear physics experiments and theory for astrophysics applications. For example, CaNPAN tries to investigate, as new astrophysics scenarios are developed in response to astronomical observations, what is the impact of nuclear physics data uncertainty, and which reactions are most important to measure experimentally. In this presentation, geared toward the student audience on Day 1 of the CaNPAN meeting, key examples of where and how nuclear physics and astrophysics are integrating, what the CaNPAN approach is, what the different astrophysical modelling approaches in CaNPAN are, and where how CaNPAN can help our community address the great challenges in nuclear astrophysics in the future.

**Presenter:** HERWIG, Falk (University of Victoria)

**Session Classification:** Morning

Contribution ID: **11** Type: **not specified**

# Amanda Edwin: Direct Measurement of Resonance Properties of 23Mg(p,γ)24Al Reaction Occurring in Classical Novae using DRAGON Recoil Separator and an Optimized Array of BGO, LaBr and CeBr Gamma Ray Detectors

*Wednesday, 1 May 2024 10:00 (20 minutes)*

One of the reactions that has an observable effect on classical nova nucleosynthesis is the proton capture on radioactive 23Mg, resulting in 24Al plus a γ. The 23Mg(p, γ)24Al has been investigated through a variety of experimental and theoretical means in the past. These investigations include a direct measurement of the strength and energy of the dominant resonance in this reaction, using a radioactive 23Mg beam at the DRAGON facility at TRIUMF in 2010. Although this measurement effectively detected the 24Al recoils in coincidence with γ rays, the beam energy was slightly too low. Hence it is possible that beam might have reached the resonance energy in non-equilibrium region of the target, invalidating the results. This was evident in 2015, when a high-resolution mass measurement of 24Al suggested a resonance energy that is inconsistent with the DRAGON result.

Due to the existing inconsistency in resonance energy of the 23Mg(p, γ)24Al reaction, this research aims to assess the resonance properties of 23Mg(p, γ)24Al reaction by using an array of fast timing detectors for detecting γ- rays. This new measurement couples the DRAGON recoil separator to an optimized array of fast-timing LaBr, CeBr and BGO detectors. The ultra-fast timing properties of LaBr and CeBr will be used to measure the time between the origination of the pulsed 23Mg beam and the detection of the γ rays. This time difference will then be used to determine the position in the target at which the reaction occurred by the resonance timing technique. The precise determination of the resonance position will be converted into a precise measurement of the energy and strength of the resonance, thus resolving the discrepancy between existing measurements in the literature.

The newly determined reaction rate will be incorporated into nova simulation codes which will determine its impact on nucleosynthesis in classical novae. These calculations will be performed using the NuGRID nova post-processing code for a variety of nova models where the 23Mg(p, γ)24Al reaction is important.

**Presenter:** EDWIN, Amanda (Saint Mary's University)

**Session Classification:** Morning

Contribution ID: **12** Type: **not specified**

# Maeve Cockshutt: Using Cool-Bottom Processing in RGB and AGB stars to explain Isotopic Ratios in Presolar Grains

*Wednesday, 1 May 2024 10:20 (20 minutes)*

Current stellar nucleosynthesis models fail to reproduce the measured isotopic abundances in group 2 oxygen-rich presolar grains, which are characterized by large 18O depletions. It was proposed that cool bottom processing in low-mass AGB stars is responsible for the observed isotopic abundances. We modeled cool-bottom processing during the RGB and the AGB of $1.2M_{\odot}$ stars to predict surface 18O/16O, 17O/16O, and 26Al/27Al ratios. In a $1.2M_{\odot}$ star effective secular mixing must work against the steep mean molecular weight (μ) gradient at the bottom of the radiative zone below the convective envelope to overcome a net increase in μ on the order of 0.01% to recreate observed isotopic ratios. Sensitivity tests in which 18O(p, α)15N and 16O(p, γ)17F were varied using reaction rate of factors of 10/0.1 and 1.4/0.71 respectively suggest that nuclear physics input is an important factor in model-grain comparison. This work shows that a secular cool-bottom mixing model that preserves stratification is a viable origin mechanism of the isotopic ratios observed in grains. We will also present an analysis of the surface 26Mg/24Mg, and 25Mg/24Mg ratios, $2M_{\odot}$ and $3M_{\odot}$ stars, and Monte Carlo impact studies on a range of reactions using current experimental uncertainties.

**Presenter:** COCKSHUTT, Maeve (University of Victoria)

**Session Classification:** Morning

Contribution ID: **13** Type: **not specified**

# Manraj Shergill: Investigating the 38K(p,γ)39Ca Reaction Rate for Classical Novae

*Wednesday, 1 May 2024 11:00 (20 minutes)*

This research investigates the 38K(p,γ) 39Ca reaction rate, a crucial process in classical novae nucleosynthesis. Classical novae, characterized by sudden brightness surges followed by fading, result from explosive hydrogen-rich material ignition on white dwarf stars. Notable discrepancies between observed and predicted abundances of Ca and Ar in nova ejecta underscore the necessity of accurate reaction rate determination. Previous studies identified this reaction rate's significance in elemental production. Utilizing one-zone nova simulations, this study explores the impact of a newly measured resonance at 675 keV on reaction rates and elemental abundances. Methodologies include identifying the Gamow Peak and Window, applying quantum mechanical selection rules, calculating reaction rates and one-zone nova nucleosynthesis simulations for five different cases. Results reveal that it is possible that the 38K(p,γ) 39Ca reaction rate can account for the elemental discrepancies of Ar and Ca. This research emphasizes the importance of accurate reaction rates in resolving elemental abundance disparities and advancing our understanding of nucleosynthesis in classical novae.

**Presenter:** SHERGILL, Manraj (McMaster University)

**Session Classification:** Morning

Contribution ID: **15** Type: **not specified**

# Maude Larivière: Thallium-208 as a real-time signal for probing heavy element synthesis

*Wednesday, 1 May 2024 11:20 (20 minutes)*

Understanding the formation of the heaviest elements has long been a pivotal inquiry and recent progress spurred by LIGO's detection of gravitational waves now lead us to examine kilonovae as crucial markers in unraveling the processes behind the synthesis of those elements. Notably, the emission spectra of MeV gamma rays could lead to strong insight in the identification of individual isotopes if specific lines can be associated to specific isotopes. For example, the 2.6 MeV gamma-ray emission line from thallium-208 has been well known in various branches of science, but it has never been pointed out as a potential real-time indicator of heavy element production in an astrophysical context. In this talk, I will show that Tl-208 could be detectable ~12 hours to ~10 days, and again ~1-20 years following a Galactic neutron star merger, implying that the r process in such events is capable of synthesizing elements such as lead and gold. In addition, I will discuss the implications of Tl-208 as a potential indicator of the synthesis of heavy elements via the i process in some types of AGB stars and rapidly accreting white dwarfs. This is a strong argument for the importance of future MeV telescope missions aiming to detect Galactic events, but that may also be able to reach nearby galaxies in the Local Group.

**Presenter:** LARIVIÈRE, Maude (UBC / TRIUMF)

**Session Classification:** Morning

Contribution ID: **17** Type: **not specified**

# A Q&A Panel with CaNPAN Experts

*Wednesday, 1 May 2024 13:00 (1h 30m)*

A panel to ask our CaNPAN experts any curious question about research, scientific writing, careers in this field, the academic community, and more!

**Presenters:** RUIZ, Chris (TRIUMF); HERWIG, Falk (University of Victoria); DILLMANN, Iris (TRIUMF); CABALLERO, Liliana (University of Guelph); DENISSENKOV, Pavel (University of Victoria)

**Session Classification:** Afternoon

Contribution ID: **18** Type: **not specified**

# Stephanie Ciccone: An Exploration of La, Ba, Eu Ratios from r-process candidate sites

*Wednesday, 1 May 2024 15:00 (30 minutes)*

Neutron star mergers are an ideal environment for rapid (r-process) neutron captures to take place that lead to the production of neutron-rich nuclei far from the valley of stability. This is one encouraging site to investigate for where abundances of the heaviest elements in our Solar System and beyond are thought to have come from. We explored the r-process regime in mergers through the testing of various mass models, fission yields, and astrophysical conditions; covering several distinct hydrodynamic simulations, some of which make use of more than 1000 tracer particles. We considered elemental abundance ratios involving the key indicators Barium, Lanthanum, and Europium, ultimately aiming to investigate the spread in these ratios that the r-process can accommodate, with current conclusions discussed here. Further, we compared to stellar data, drawn from literature results compiled by JINAbase, for metal-poor stars. This work has allowed us to gain a better understanding about the production of elemental abundances in the universe and to further test the expected bounds of known nucleosynthesis process regimes.

**Presenter:** CICCONE, Stephanie (University of Guelph)

**Session Classification:** Afternoon

Contribution ID: **20** Type: **not specified**

# Mallory Loria: Illuminating Nuclear Physics Uncertainties in Astrophysics With CaNPAN Tools

*Wednesday, 1 May 2024 14:30 (30 minutes)*

Our framework, developed through the Canadian Nuclear Physics for Astrophysics Network (CaNPAN), is crucial for guiding nuclear astrophysics experiments. It has the capacity to identify key nuclear reactions responsible for element synthesis in various astrophysical phenomena. Notably, this framework has identified the 39K(p, ⊠)40Ca and 38K(p, ⊠)39Ca reactions as the most impactful for the production of calcium in novae. Additionally, the framework has been used to potentially determine the origin of pre-solar grains, constrained by existing nuclear physics uncertainties, and if they are products of intermediate neutron capture (i-process) nucleosynthesis. The results presented affirm the efficacy of the CaNPAN toolkit in identifying these areas of uncertainties for which experimental answers are needed. This research has substantial implications for experimental pursuits, like the measurement of the 38K(p, ⊠)39Ca reaction done at TRIUMF.

**Presenter:** LORIA, Mallory (University of Victoria/TRIUMF)

**Session Classification:** Afternoon

Contribution ID: **21** Type: **not specified**

# Relaxing Student Hangout

*Wednesday, 1 May 2024 16:00 (1 hour)*

**Session Classification:** Afternoon

Contribution ID: **22** Type: **not specified**

# Welcome

*Friday, 3 May 2024 09:00 (15 minutes)*

**Presenter:** HERWIG, Falk (University of Victoria)

**Session Classification:** Morning

Contribution ID: **23** Type: **not specified**

# Nuclear physics and r-process observables

*Friday, 3 May 2024 09:15 (40 minutes)*

Our understanding of the formation of the heaviest elements via rapid neutron capture (r-process) nucleosynthesis is built up through the detection and analysis of a variety of astrophysical observables: isotopic and elemental abundance patterns, electromagnetic signatures, and radioisotopes. The interpretation of each type of observable is complicated by the unknown nuclear physics of the thousands of neutron-rich species that participate in the r-process. Here we will describe a few examples of how r-process observables can be exploited to provide clues as to the nature of r-process site(s) of production, and note how current and upcoming experiments at radioactive beam facilities can provide crucial data and fresh insight.

**Presenter:** SURMAN, Rebecca (University of Notre Dame)

**Session Classification:** Morning

Contribution ID: **24** Type: **not specified**

# Illuminating astrophysical actinide production using MeV gamma-rays and metal-poor stars

*Friday, 3 May 2024 09:55 (25 minutes)*

Fingerprints of the properties of exotic nuclei on nucleosynthesis observables have been used for decades to frame our picture of how the heaviest elements in our Solar System came to be. The abundance of elements in our Sun, as well as nearby metal-poor stars, hints at multiple neutron capture nucleosynthesis processes, the slow (s), intermediate (i) and rapid (r) neutron capture processes. While the s-process terminates its heavy element production at Pb-208, we know that the r-process or i-process must be capable of going beyond since we observe long-lived actinides like U-238 in stars and traces of Cm-247 in meteorites. However which astrophysical site(s) are responsible for actinide production, and how heavy of actinides ultimately can be produced, remains unclear. Utilizing metal-poor stars rich in r-process elements, we show that signatures of fission fragments of isotopes with A~260 can be observed. Then, utilizing MeV gamma-rays, we show that a 2.6 MeV emission line of Tl-208 could be used to hunt locally for in situ neutron capture nucleosynthesis, from both i-process and r-process sources. I will also discuss the opportunity to refine our understanding through measurements at radioactive isotope beam facilities in the near future, such as constraints on neutron captures along the Tl isotopic chain. It is via studies such as these, which work to combine the current picture of leading astrophysical candidates with carefully considered nuclear data, that the big picture of heavy element origins can be teased out.

**Presenter:** VASSH, Nicole (TRIUMF)

**Session Classification:** Morning

Contribution ID: **25** Type: **not specified**

# Capture of degenerate neutrons

*Friday, 3 May 2024 10:20 (25 minutes)*

Neutron stars, accreting matter from a companion, contribute to the inventory of systems that can be explored through multimessenger astronomy. As the accreted matter interacts with ions in the neutron star atmosphere and crust, it triggers nuclear reactions, generating X-rays, p-nuclei, and potentially gravitational wave emissions. Gravity draws the newly synthesized nuclei into deeper layers where neutrons are degenerate. In this talk, I will discuss the role of neutron degeneracy in radiative neutron capture rates, as well as the sensitivity of these degenerate rates to nuclear physics input.

**Presenter:** CABALLERO SUAREZ, Liliana (University of Guelph)

**Session Classification:** Morning

Contribution ID: **26** Type: **not specified**

# On possible observational signatures of i-process nucleosynthesis in presolar dust grains

*Friday, 3 May 2024 11:15 (25 minutes)*

Multiple signatures of nucleosynthesis in asymptotic giant branch stars, classical novae, and supernovae have been revealed by analyzing CNO, Al, S, Ca, Ti, Ba, and other isotopic abundance ratios in presolar dust grains. I will show that in some grains the measured Zr, Mo, and Ru isotopic ratios can be interpreted as possible signatures of i-process nucleosynthesis.

**Presenter:** DENISSENKOV, Pavel (University of Victoria)

**Session Classification:** Morning

Contribution ID: **27** Type: **not specified**

# (*R) Mass Ejection from Neutron Star Mergers

*Friday, 3 May 2024 11:40 (25 minutes)*

The coalescence of neutron stars, either among themselves or with black holes, generates significant gravitational and electromagnetic waves, and is a key site for r-process element production. The ejection of mass during and after these mergers shapes the heavy element yield and electromagnetic signal, involving a complex interplay of processes and dependencies. This talk will provide an overview of the various mechanisms of mass ejection and their impact on r-process production and electromagnetic emission.

**Presenter:** FERNANDEZ, Rodrigo (University of Alberta)

**Session Classification:** Morning

Contribution ID: **28** Type: **not specified**

# New discoveries with gravitational-wave astrophysics

*Friday, 3 May 2024 13:30 (25 minutes)*

In the last six years, the field of gravitational wave astrophysics has grown from a groundbreaking first discovery to revealing new populations of black holes and neutron stars through distant cosmic collisions, which has provided new insights into extreme spacetime curvatures, cosmology, and ultra-dense matter as well as the origin of heavy elements. I'll give an overview of the current Advanced LIGO detectors and summarize recent results from the LIGO-Virgo-KAGRA network and their wide-reaching implications. I'll close with prospects for the future of multi-messenger astrophysics with gravitational wave detectors on Earth and in space.

**Presenter:** MCIVER, Jess (UBC)

**Session Classification:** Afternoon

Contribution ID: **29** Type: **not specified**

# (*R) Cosmic collisions: nuclear astrophysics with gravitational waves

*Friday, 3 May 2024 13:55 (25 minutes)*

Multimessenger observations of GW170817 indicate that binary neutron star (BNS) mergers are sites for rapid neutron-capture (r-process) nucleosynthesis. However, it remains an open question whether BNS mergers can account for all the r-process element enrichment in the Milky Way's history. I will discuss what GW170817 and subsequent gravitational-wave observations are teaching us about the neutron star population and the properties of ultra-dense matter, and what this implies for BNS mergers' contribution to the chemical evolution of the Galaxy.

**Presenter:** LANDRY, Phil (CITA)

**Session Classification:** Afternoon

Contribution ID: **30** Type: **not specified**

# (*R) Gravitational Laboratories for Nuclear Physics

*Friday, 3 May 2024 14:20 (25 minutes)*

The structure of neutron stars provides a unique way to probe two fundamental physical interactions: gravity and the strong nuclear force. I will review our current understanding of the macroscopic properties of neutron stars and discuss associated constraints on microscopic phenomenology, including the presence of strong phase transitions. Time permitting, I will also discuss how well we can distinguish neutron stars from black holes within gravitational-wave signals from coalescing compact binaries.

**Presenter:** ESSICK, Reed (CITA)

**Session Classification:** Afternoon

Contribution ID: **31** Type: **not specified**

# Discussion with coffee

*Friday, 3 May 2024 14:45 (30 minutes)*

**Session Classification:** Afternoon

Contribution ID: **32** Type: **not specified**

# End of workshop

*Friday, 3 May 2024 15:15 (5 minutes)*

**Session Classification:** Afternoon

Contribution ID: **33** Type: **not specified**

# Discussion

*Thursday, 2 May 2024 13:20 (20 minutes)*

Open time for discussion

**Session Classification:** Afternoon