VOL 1 - ISSUE 2 - 2025

# MAX-NUCLEAR QUARTERLY

Materials at Extremes-Nuclear at Queen's University Newsletter

## A LOOK INSIDE THIS ISSUE:



## WELCOME FROM PROF. MARK DAYMOND

Welcome to the second issue of MAX-Nuclear Quarterly! This edition brings you updates on the exciting research happening at Queen's, where we continue to explore the mechanics, irradiation, modeling, analysis, and corrosion of materials used in nuclear power production. We're also introducing some more of the brilliant team members who make this work possible in our labs, alongside highlights from our recent activities.

The year has gotten off to a strong start, with new graduate students and postdoctoral researchers joining the group. We're also thrilled to announce that we've gained access to our new building at 92 Grant Timmins Drive, conveniently located next door to the RMTL. This newly refurbished space will house the Microscopes and Ions for Small Modular Reactors (MISMR) laboratory, further expanding our research infrastructure. In addition, we'll be relocating equipment from both the Main Campus and the RMTL annex (WTS), bringing more of our activities under one roof. The first major installation at the new site is Prof. Balogh's cutting-edge rotating anode X-ray diffraction facility.

In other exciting news, MAX-Nuclear proudly supported the Frontenac, Lennox, and Addington Science Fair, held in late March at Duncan McArthur Hall, Queen's University. We sponsored a Special Award for presentations related to "low carbon energy". Photos from the event will be featured in the next issue. A big thank you to the graduate students who volunteered their time to assist with judging at the fair!

Despite the ongoing economic uncertainties, there is a strong and growing momentum in the nuclear power sector. The Ontario government has directed Ontario Power Generation (OPG) to plan for new nuclear energy generation at their Wesleyville site near Port Hope, likely a large-build multi-unit facility, similar to the planned expansion at Bruce Power. In addition, Small Modular Reactors (SMRs) continue to gain traction as a sustainable solution to support data centers and AI infrastructure. We're excited to share more groundbreaking research, innovative projects, and collaborative initiatives from our group in the coming issues. Thank you for joining us on this journey at Queen's MAX-Nuclear!

*Mark*

**Mark R. Daymond, PhD, PEng, Professor**

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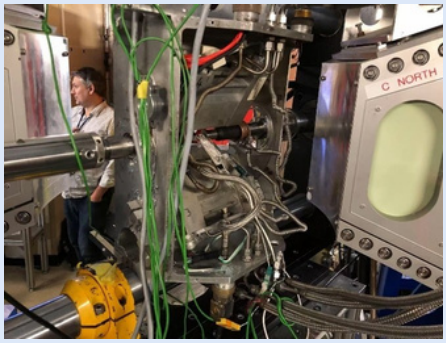
# 1ST QUARTER HIGLIGHTS

## Prof. Mark Daymond and team performed experiments in the UK

Prof. Daymond led a team of four (Dr. Fei Long, PhD student Icaro Santos, and MASc student Nathan Jones) to travel to Diamond Light Source and ISIS Neutron and Muon Source in the UK, at the end of February. These large-scale facilities award facility time through a peer-review process and allow experiments not possible in the university lab. At Diamond Light Source, the team used high energy synchrotron x-rays to carry out in-situ phase transformations studies on the formation of hydrides in zirconium alloys.

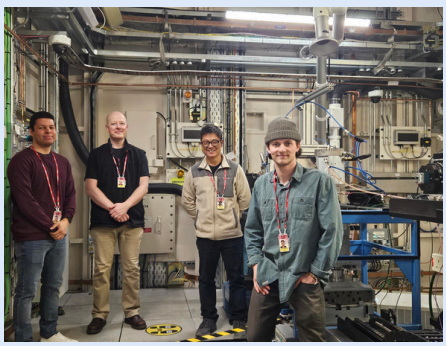
The other experiment was carried out at the ENGIN X beamline at ISIS – a facility which Prof. Daymond designed and built before coming to Queen's. This project explored the effect of hydrogen on the mechanical behavior of Zirconium alloys by running mechanical tests at elevated temperatures while acquiring neutron diffraction spectrums in-situ. The experiment took advantage of deep penetration of neutron (mm scale) to probe the deformation behavior change in large specimens.

MASc student Nathan Jones installing a sample at the beamline.



An Instron mechanical testing frame installed onto the beamline.

During the trip, Prof. Daymond and Dr. Long also visited the materials research facility at the nearby Culham Centre for Fusion Energy (UKAEA), and discussed potential international collaborations using RMTL facilities to support materials research for fusion applications.



Prof. Mark Daymond with Dr. Fei Long, Icaro Santos and Nathan Jones.

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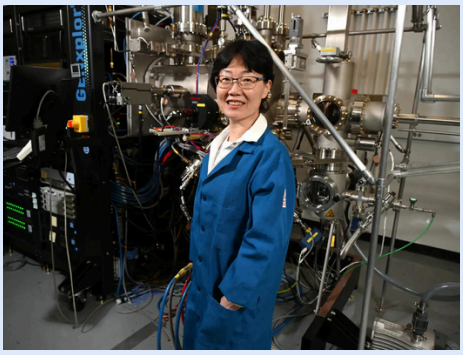
# 1ST QUARTER HIGLIGHTS

## The Queen's Gazette highlights Dr. Yanwen Zhang's contributions to materials science and the move towards clean and sustainable energy solutions

Shared from The Queen's Gazette.

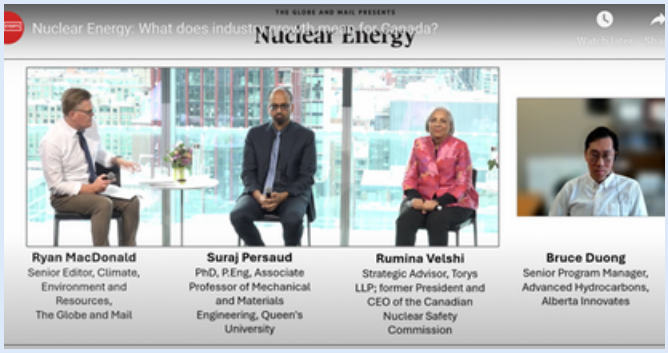


Dr. Yanwen Zhang

From Marie Curie's pioneering research on radiation to today's leading scientists, women have played a crucial role in shaping our understanding of the physical world. As International Women's Day on March 8 highlights the pursuit of equity across all fields, it is also a moment to recognize the researchers driving innovation today. Nearly a year into her role as Canada Excellence Research Chair in Impact of Radiation in Energy and Advanced Technologies at Queen's, Dr. Yanwen Zhang (Smith Engineering) is building on this legacy through her work enhancing materials for use in extreme environments.
**READ MORE**

## Dr. Suraj Persaud participated in The Globe and Mail's panel discussion on the future of nuclear energy

Shared from The Globe and Mail.




Dr. Suraj Persaud with other panel speakers discussing commercialization of small modular reactors (SMRs).

Governments and utilities are working to expand Canada's nuclear energy capacity in response to growing demand for electricity and goals of net-zero. Refurbishments and new reactors represent billions of dollars in investments and a sizeable economic impact. At the same time, small modular reactors (SMRs) are emerging as an alternative to fossil fuels in areas such as remote communities, and for industry. On February 14, 2024 The Globe and Mail hosted an event where industry experts discussed the future of nuclear, how it's reshaping the nation's energy mix and why it matters. **READ MORE**

## Dr. Yanwen Zhang selected as one of the Science Meets Parliament - Ontario delegates

Congratulations to Dr. Zhang for being selected as one of the delegates of the first edition of Science Meets Parliament - Ontario! Aimed at strengthening the connection between the science and policy communities in Ontario, the program provides an excellent opportunity for the province's researchers, such as Dr. Zhang, to learn about the process of policymaking at the provincial Legislative Assembly. **LEARN MORE**

# UPCOMING EVENTS

## 49th CNS/CNA Student Conference

June 8-11, 2025 | Westin Harbour Castle Hotel Toronto


**Early bird registration deadline: April 30, 2025**
**For more information and to register, visit the CNS Conference website**

## SCIENCE RENDEZVOUS KINGSTON 2025

May 10, 2025 | 10 am - 3 pm | Slush Puppie Place


**MAX-Nuclear joins this year's Science Rendezvous!**
Visit our booth and experience the "Wonders of Nuclear Energy"!

**For more information on the event, visit the Science Rendezvous website**

# INDUSTRY NEWS

## *GOVERNMENT OF CANADA ANNOUNCES MAJOR NUCLEAR ENERGY INVESTMENTS*

Shared from CNA

The Government of Canada has demonstrated its strong commitment to nuclear energy development through a series of significant funding announcements aimed at bolstering the country's position as a global leader in the nuclear sector.

**CANDU Development Funding**

On March 5, 2025, the Honourable Jonathan Wilkinson, Minister of Energy and Natural Resources, announced that the Government of Canada has entered into a preliminary agreement with AtkinsRéalis to support the development and modernization of a new, large-scale, natural uranium–fuelled Canadian deuterium uranium (CANDU) nuclear reactor. The agreement includes a loan of up to $304 million over four years to finance half of the design project.

This investment follows the recent approval of a $2.85 billion contract to extend the life of the Unit 1 CANDU reactor at the Cernavoda Nuclear Power Plant in Romania. The contract was awarded by Romania's national nuclear power operator, Nuclearelectrica S.A. (SNN), to a consortium including the Canadian Commercial Corporation (CCC), Candu Energy (an AtkinsRéalis company), Ansaldo Nucleare, and Korea Hydro & Nuclear Power (KHNP).

**READ MORE**

# SPOTLIGHT: MEET THE MAX-NUCLEAR TEAM

**Maryam Rezvanian**
PhD candidate

*I have a background in materials and metallurgy engineering from the University of Tehran, where I focused on surface engineering and electrodeposition coating. I chose Queen's Smith Engineering for my PhD because of its great reputation in mechanical and materials engineering, the collaborative environment, and the chance to work with experts in the materials group.*

*One of the most exciting parts of my studies has been exploring corrosion in molten salts. Working with the nuclear materials group has been a great experience, thanks to the supportive mentorship and the cutting-edge research. I'm eager to continue investigating corrosion mechanisms in my PhD, contribute to innovations in nuclear materials, and collaborate with both academic and industry experts to grow, learn, and make a positive impact.*

**Brock Nowak**
PhD candidate

*I received my bachelor's degree in mechanical engineering from Queen's University in 2021 with a professional internship at Goodyear Canada, and a Certificate in Mining Technologies.*

*My capstone project was related to the deployment of SMR technologies to remote mining communities, investment in nuclear technologies was on the rise, and I had experience as a child around the Darlington Nuclear Power Plant, so it seemed like an excellent career path to embark on.*

*I am currently working on fabricating, testing, and characterizing coated zirconium alloys for enhanced accident tolerance of fuel cladding materials. This involved commissioning a magnetron sputtering physical vapor deposition chamber for coating fabrication, and a high temperate steam furnace capable of reaching 1130 C for testing materials in accident conditions.*

*Throughout my studies I have had the opportunity to attend conferences in New Orleans (AMPP), Las Vegas (TMS) and several across Canada (UNENE, CNS, CCEM), presenting my research and contribution towards advancing the understanding of how coated accident tolerant fuels perform in extreme environments. I also take pride in the efforts I have put towards growing interest in materials science at the undergraduate level, founding two new clubs: Queen's University Material Advantage Student Chapter (QUMAC) and QBlade. I am also the Chapter Lead for the Queen's University North American Young Generation in Nuclear (NAYGN) Chapter.*

# SPOTLIGHT: MEET THE MAX-NUCLEAR TEAM

## Irin Wattanapiyarom

PhD candidate

*I completed both my undergraduate and master's degrees in chemical engineering in Thailand. Before pursuing my master's, I worked at PTT Exploration and Production Public Company Limited (PTTEP, Thailand) for approximately two years. During this time, I noticed significant transformations in the oil and gas industry, particularly the shift toward clean energy and the development of future energy sources. As a part of my master's program, I had the opportunity to be a visiting student at the University of New Brunswick, where I had a chance to talk to a nuclear professor and several students in the group. Their insights and interesting projects greatly inspired my interest in nuclear energy.*

*I started my PhD in September 2024 and recently passed the comprehensive exam part A. My research focuses on the corrosion behavior of alloy 800 in high-temperature gaseous environments for use in gas-cooled reactors. I believe that the valuable knowledge and experiences I gain from Queen's University will contribute to my accomplishments and pave the way for a successful future career.*

## Shayan Dehghan

Postdoctoral Researcher

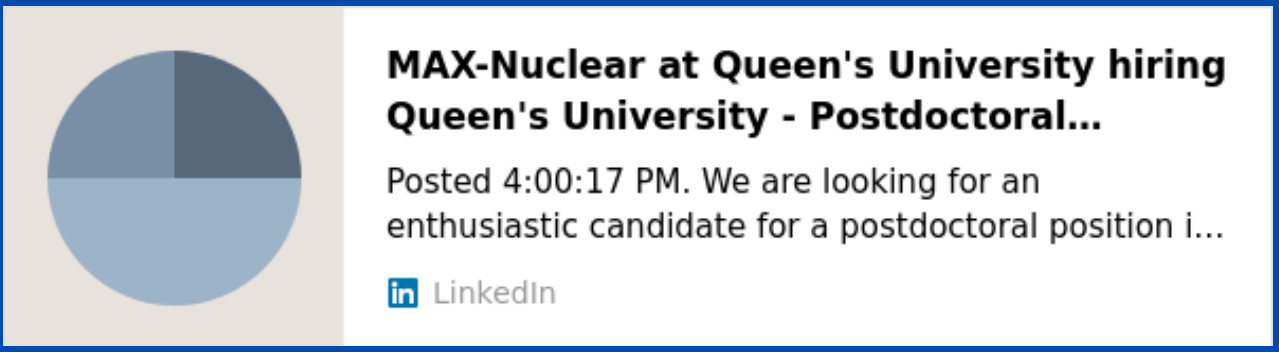
*I'm a postdoctoral fellow in the nuclear materials group at Queen's University, supervised by Professor Mark Daymond. I received my Ph.D. in mechanical and manufacturing engineering from University of Putra Malaysia and my M.Sc. and B.Sc. in mechanical engineering from Iran. I was born in Germany, grew up in Iran, then moved to Malaysia, and now I am in Canada—a journey that enriched both my professional and personal life.*

*Prior to joining Queen's University, I was postdoctoral fellow at Université du Québec à Rimouski, where I was involved in different funded research projects sponsored by NSERC, MITACS, and FRQNT. The research projects were focused on metal additive manufacturing and laser material processing of advanced alloys. Throughout my academic path, I have published numerous papers in high-ranked journals and had the opportunity to mentor M.Sc. and Ph.D. students, experiences that have greatly enhanced my growth as a researcher and academic.*

*Joining Prof. Daymond's team at Queen's University presented a unique opportunity to expand my knowledge of materials behavior under extreme environments while contributing to high-impact projects within Canada's nuclear research landscape. The collaborative environment and access to world-class research facilities make this position an ideal fit for both my scientific development and long-term career goals. I am excited to be part of this cutting-edge research group, contribute to Canada's advancements in nuclear science, and continue growing as a researcher and scientist. In this postdoctoral role at Queen's University, I am most looking forward to deepening my knowledge about nuclear materials and building strong research collaborations that can lead to meaningful technological advancements.*

*In addition to my academic growth, I am always seeking to develop my personal qualities. I have a deep appreciation for nature and enjoy spending time outdoors—whether it is through nature photography, skiing, or exploring local culture and history.*

# JOB BOARD




We are looking for an enthusiastic candidate for a postdoctoral position in mechanical properties, irradiation effects and microstructure characterization of engineering alloys. This position will support activities of the UNENE Research Chair in Nuclear Materials.

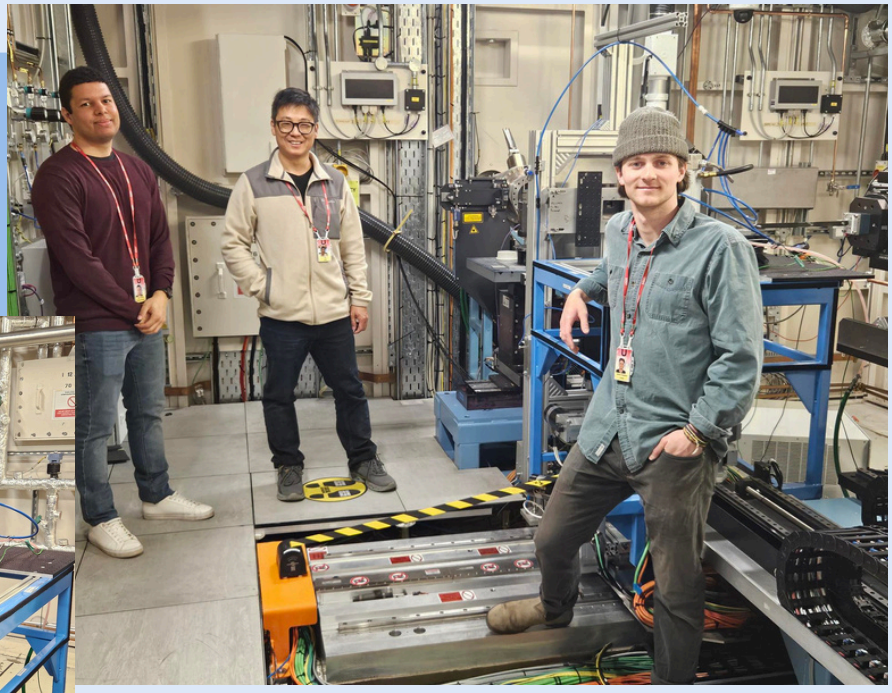
**View job posting HERE**


We are looking for an enthusiastic candidate for postdoctoral position(s) on modeling defect formation and dynamics in complex alloys and ceramics. This position will be part of the recently $8M funded Impact of Radiation in Energy and Advanced Technologies CANADA EXCELLENCE RESEARCH CHAIRS (CERC) program.

**View job posting HERE**

# SNAPSHOTS AND ANNOUNCEMENT

More photos from Prof. Daymond and team's UK trip.



Congratulations to **Arash Nikniazi** for achieving his SOLIDWORKS CAD Design Professional (CSWP) certification!

*follow us on*

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