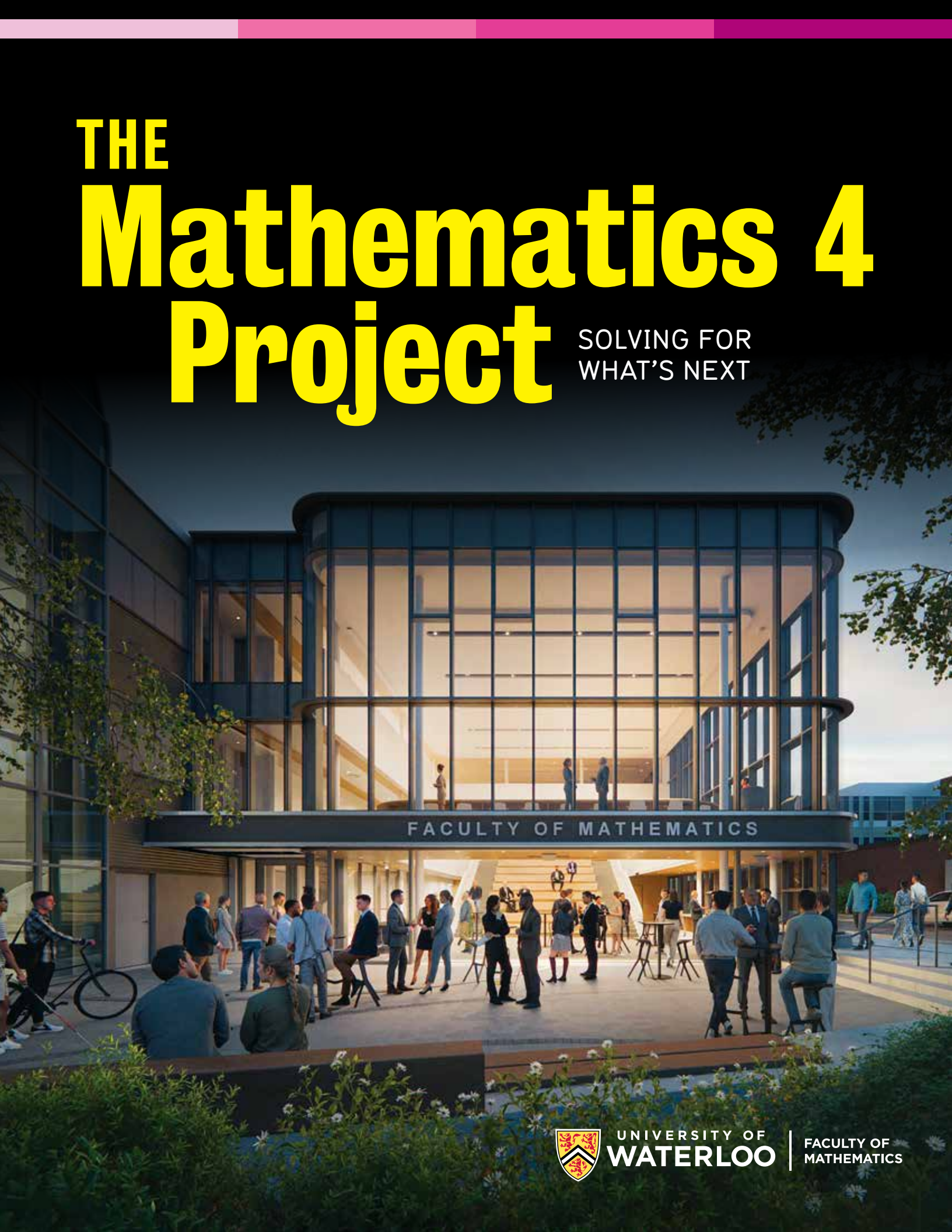
THE Mathematics 4 Project

SOLVING FOR WHAT'S NEXT



UNIVERSITY OF WATERLOO | FACULTY OF MATHEMATICS


ONE

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Students celebrating the Pink Tie Pledge during Orientation Week



The vision

Breakthroughs in frontier technologies – including artificial intelligence and quantum computing – are transforming how we discover, solve problems and understand the world. Their promise is immense: accelerating drug discovery, improving climate models, optimizing energy grids and boosting productivity across industries.

Yet they also raise pressing concerns. Many are asking: How secure are the AI and quantum systems that increasingly handle our data? What is the environmental cost of new computing technologies? How can we prepare future generations to thrive in an AI-driven world?

The University of Waterloo's Faculty of Mathematics is unlocking the potential of these technologies responsibly. With leading expertise in AI, quantum and cryptography, we are driving foundational breakthroughs and shaping the tools, frameworks and talent that will define the future. As North America's only math faculty and one of the world's largest concentrations of mathematical talent, we're ideally suited for the task.

But to continue this work, we need new spaces for collaboration and discovery. Mathematics 4 (M4) will do exactly that. It will connect students, researchers and partners in new ways, creating space to explore ideas, experiment across disciplines and translate breakthroughs into real-world innovations.

You can help us make M4 a reality.



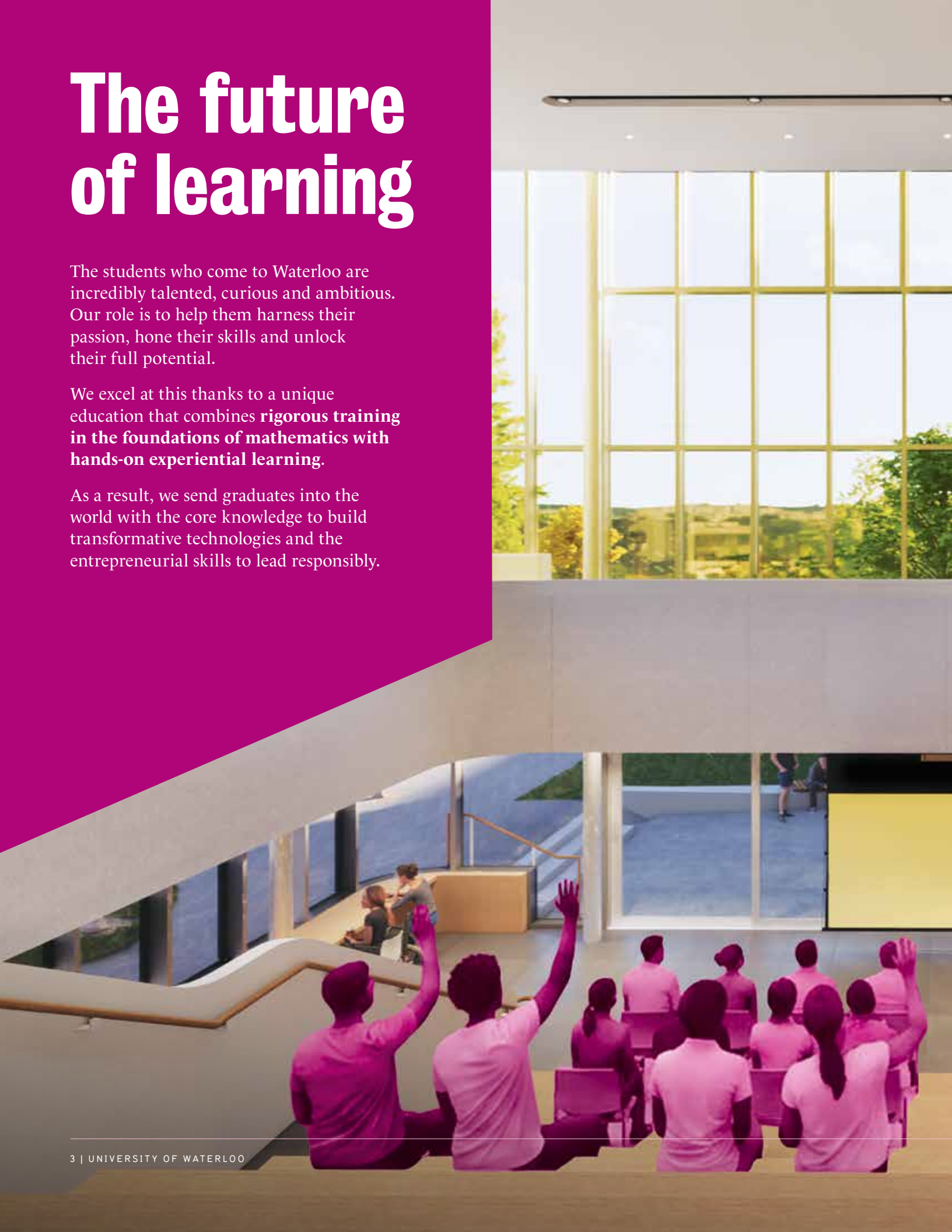
JOCHEN KOENEMANN
Dean, Faculty of Mathematics

The future of learning

The students who come to Waterloo are incredibly talented, curious and ambitious. Our role is to help them harness their passion, hone their skills and unlock their full potential.

We excel at this thanks to a unique education that combines **rigorous training in the foundations of mathematics with hands-on experiential learning**.

As a result, we send graduates into the world with the core knowledge to build transformative technologies and the entrepreneurial skills to lead responsibly.

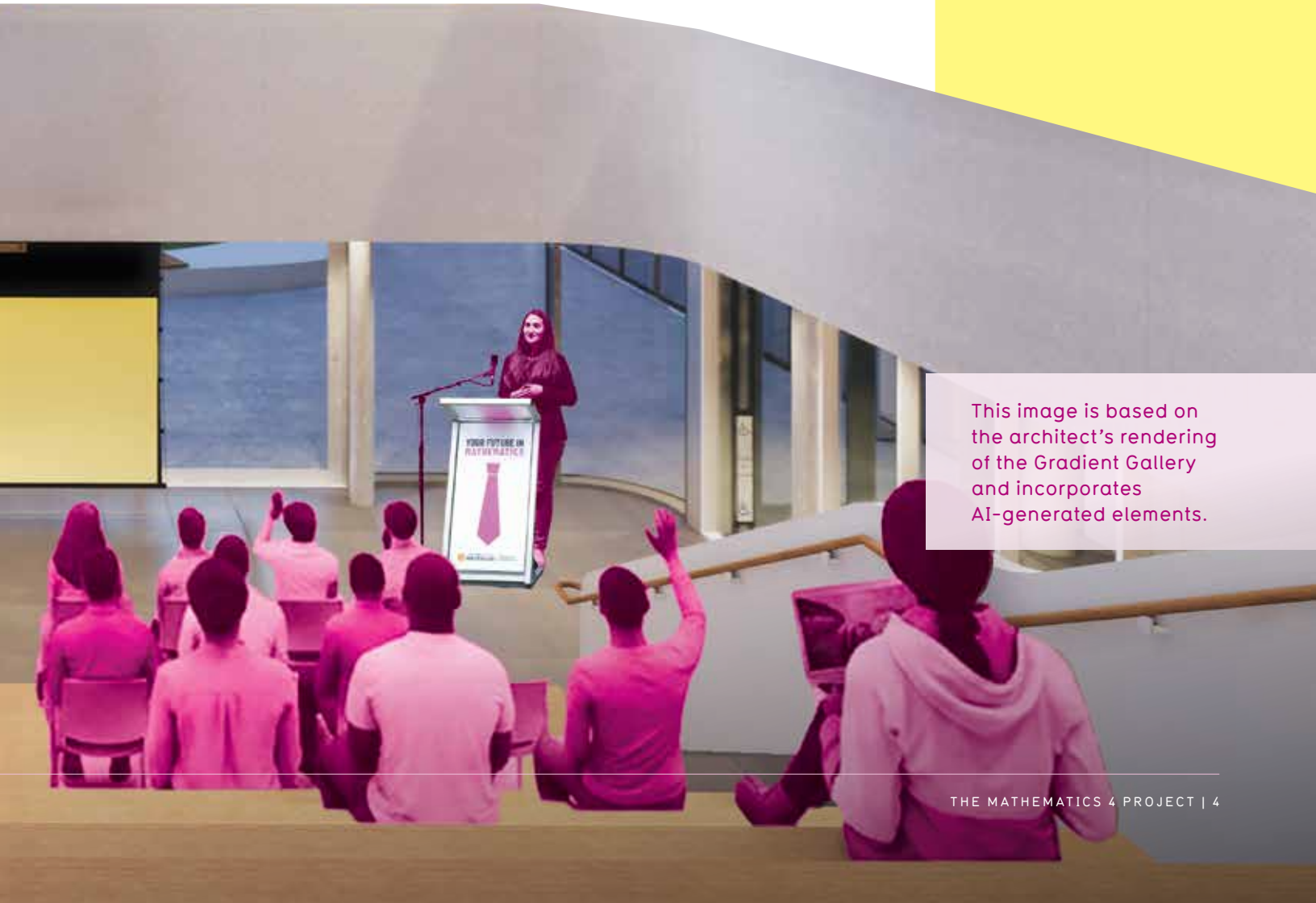


M4 is the next step in our rich educational tradition.

It will provide:

- **Classrooms that promote active learning** – where students move, sketch, test, debate and build, and where learning is always creative and interactive.
- **Lounges and collaboration spaces that spark conversation** – where a chance encounter between a statistician and computer scientist sparks a new interdisciplinary project.
- **A flexible event space (the Gradient Gallery) that will unite the community** – one that can accommodate a Centre for Education in Mathematics and Computing (CEMC) outreach event in the morning, a capstone showcase in the afternoon and an alumni founder's AMA in the evening.

M4 will be a home where students feel supported as they explore new ideas and build future-proof skillsets.



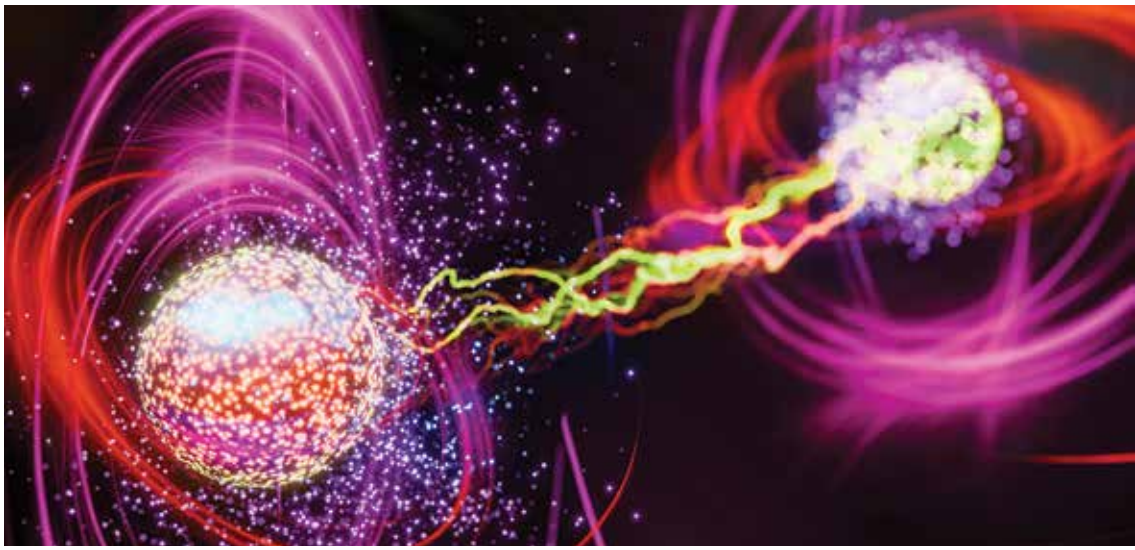
This image is based on the architect's rendering of the Gradient Gallery and incorporates AI-generated elements.

The future of innovation

M4's cutting-edge labs and server rooms will enable our researchers, students and partners to realize the potential of new technology while mitigating its perils.

M4 is where we will:

Drive the foundational breakthroughs behind next-generation AI and quantum technologies.





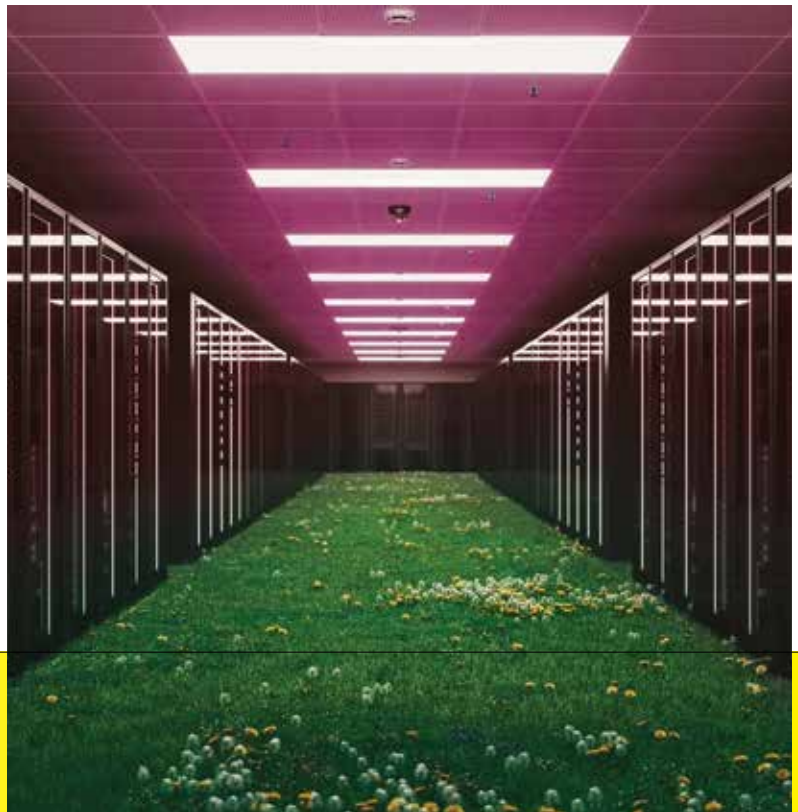
Design cryptographic methods that secure data and preserve privacy.



Develop tools to understand and better manage financial risk, ensuring a more stable and prosperous economy.

Develop powerful and reliable computing infrastructure capable of supporting next-generation AI and quantum systems.



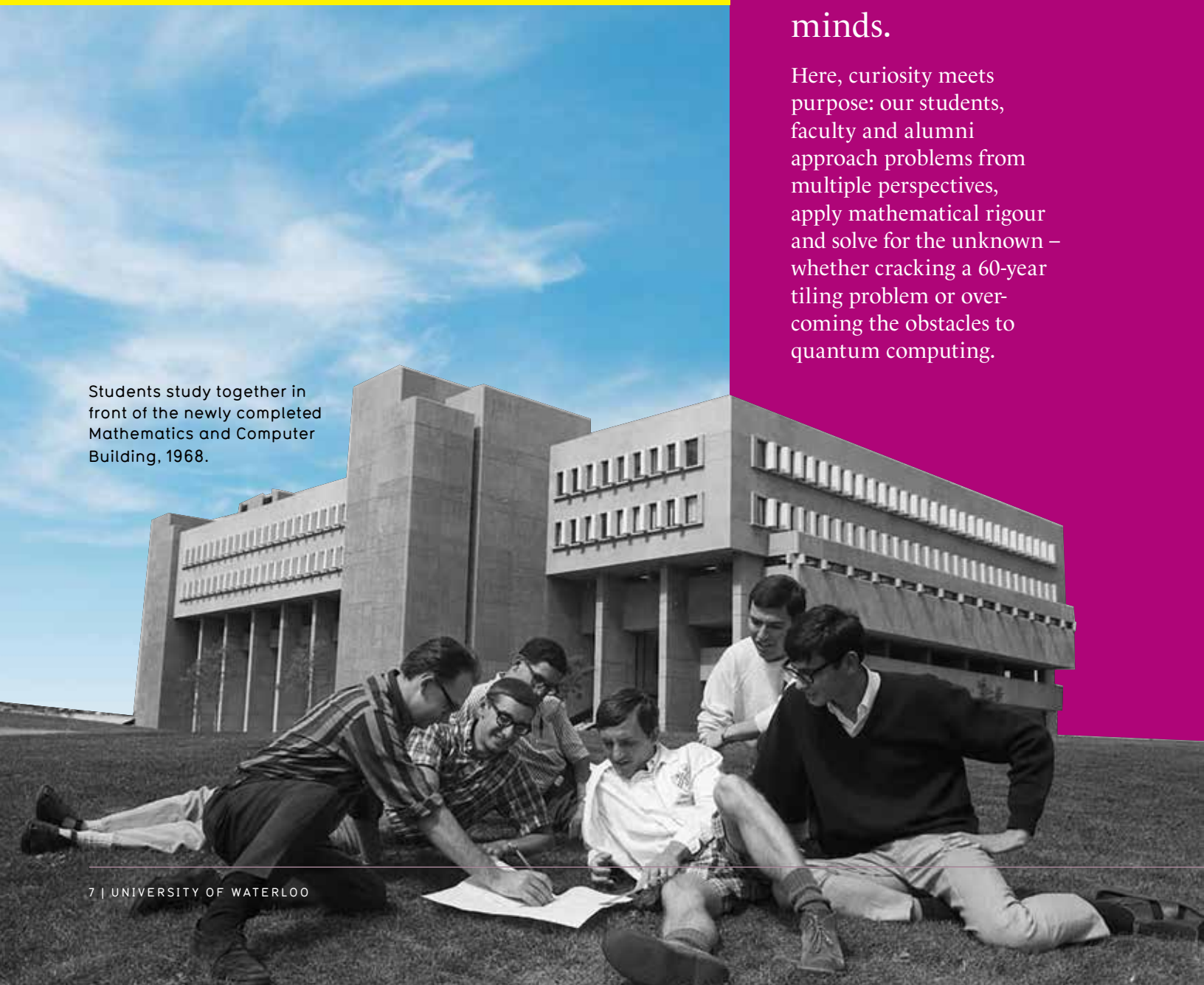


Improve the energy efficiency of AI models, ensuring computing advances do not come at the expense of the planet.

Why Waterloo Math?

The Faculty of Mathematics has always been a top destination for exceptional mathematical minds.

Here, curiosity meets purpose: our students, faculty and alumni approach problems from multiple perspectives, apply mathematical rigour and solve for the unknown – whether cracking a 60-year tiling problem or overcoming the obstacles to quantum computing.



Students study together in front of the newly completed Mathematics and Computer Building, 1968.

Over the course of our storied history, we have taught generations to code through accessible, education-focused software (WATFOR and WATCOM), helped secure the world's digital communications through foundational research (Certicom), and transformed how knowledge is organized and discovered through advances in text retrieval and indexing (The Oxford English Dictionary project and OpenText).



Waterloo's iconic **Red Room** drove innovation in computing for decades.



Scott Vanstone, **Gordon Agnew** and **Ron Mullin** founded **Certicom**, commercializing elliptic-curve cryptography and creating a global standard for securing communications.

Craig Kaplan helped solve a 60-year tiling problem by discovering a hat-shaped tile that can cover an infinite plane with patterns that never repeat.

Now, we're leading in the technologies shaping tomorrow – AI, quantum and cryptography.

These technologies have their foundations at the intersection of mathematics, computer science and statistics – disciplines that Waterloo has united in North America's only standalone Faculty of Mathematics for decades.

M4 strengthens our culture of connection. Centrally located at the heart of the math district, with linkages to each math building, M4 unites our community.

Plotting our growth

Timeline of campus expansion

1968

The Mathematics and Computer (MC) building opens. Designed in brutalist style, MC became the largest building on the University's young campus. It featured the iconic Red Room, which housed Waterloo's mainframe super-computer, placing the university at the forefront of computing research and education.



1988



The Davis Centre (DC) opens. A daring design, DC was described at opening as "a metaphor for the visual world of the computer monitor." Completed during the rise of personal computing, DC symbolized Waterloo's evolution into a high-tech hub.

2011

Mathematics 3 (M3) opens. This modern, 90,000-square-foot building was built to house the Department of Statistics and Actuarial Science, and to encourage growth in computational intelligence, health informatics and new media technologies.





Mathematics 4 (M4) opens.
Set to open during the Faculty's 60th anniversary, M4 is designed to catalyze research and education in AI, quantum and cryptography, solidifying the Faculty's reputation as a global innovation centre.

2027

Explore M4

As we approach our 60th anniversary, the Faculty of Mathematics stands on the threshold of an exciting new era of growth, innovation and impact. Mathematics 4 (M4) makes this new era possible.

Explore the spaces that will define our next 60 years.









The West Lobby

The West Lobby will be the signature entrance to M4, giving visitors an unforgettable first impression of the Faculty of Mathematics.

With sweeping views, bold architecture, and refined finishes, it embodies our spirit of innovation and ambition.

It will also be warm and inviting, offering open seating and easy access to the cafeteria – an ideal place to gather, connect or recharge.

As one of the most striking architectural spaces on campus, the West Lobby will elevate our profile and become a vibrant hub for the Math community – strengthening connection, pride and a shared sense of identity across the Faculty.

"The Faculty of Mathematics brings together people who are curious, collaborative and stubborn. We find ways to bring the best out of each other. We make space for students not just to grow as students, but as people. We invest in our future as a faculty."

CATHERINE DONG
Undergraduate student and senate member



The Gradient Gallery



Skyfold door

Opening on courtyard, enabling indoor-outdoor events

Indigenization

Ventilation system that will allow smudging ceremonies

2nd floor gallery

A feature wall will honour and celebrate donors

The Gradient Gallery is a two-level, open-concept event space featuring a gallery, stadium seating and a skyfold door leading outdoors.

The Gradient Gallery will host CEMC outreach, entrepreneurial programs, alumni gatherings, public lectures and community events, and serve as a casual meeting and study space when not in use. Designed to support Indigenous ceremonies, it faces East and includes ventilation for smudging.

The Gradient Gallery will be the first space many math students see at the University of Waterloo when they visit for a CEMC or recruitment event or a first-year orientation activity. And it will become a space they return to again and again throughout their time as a student and then as a returning alum. It will become an iconic part of the Faculty of Mathematics campus presence and hold a special place in the hearts of future Mathies.

The Polymorphic Classroom

Designed to enable rapid transitions between lectures and collaborative breakout work, this unique classroom supports active, problem-driven learning.

Located prominently on M4's first floor, the Polymorphic Classroom will host the CEMC outreach programs, entrepreneurship workshops, graduate and undergraduate seminars, and much more. It will provide a dynamic environment for collaboration, creativity and deep engagement.

"Over the last 15 to 20 years, we've really discovered how important active learning is. Having space that is functional in that regard is incredibly important. It will help students engage with the fun that can be part of mathematics."

IAN VANDERBURGH
Associate Vice-President, Strategic Enrolment Management and Associate Professor, Teaching Stream, CEMC





The Nexus

Located at the crossroads of four Math buildings, the Nexus is a third-floor lounge and collision space where students, faculty and staff will naturally connect.

Designed for accessibility and comfort, it features generous ramps, ample seating, and inviting areas for conversation and collaboration.

As a high-traffic gathering place, the Nexus creates the conditions for spontaneous encounters – where ideas are shared, relationships form and innovation emerges through everyday interaction.



"Student space is in high demand. Having those places for students to hang out and organically meet and work with each other is really important. I think that's how you keep people invested in mathematics – doing it together. The coolest thing you do in a math degree is having that 'aha' moment as a group."

KEELEY ISINGHOOD
Graduate student in Biostatistics

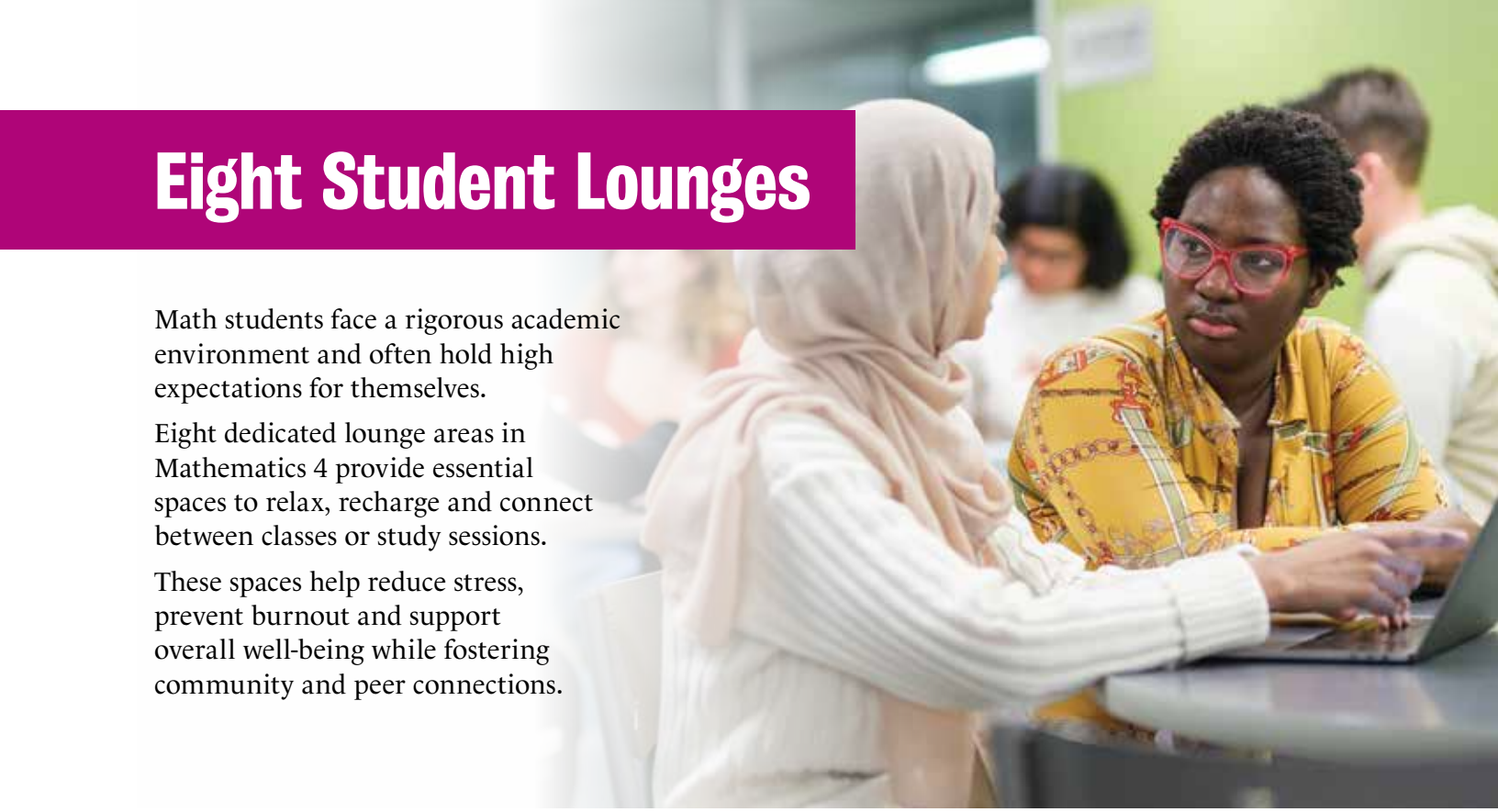


Eight Student Lounges

Math students face a rigorous academic environment and often hold high expectations for themselves.

Eight dedicated lounge areas in Mathematics 4 provide essential spaces to relax, recharge and connect between classes or study sessions.

These spaces help reduce stress, prevent burnout and support overall well-being while fostering community and peer connections.



Four Breakout Rooms

Four breakout rooms on the first floor of Mathematics 4 will provide dynamic collaboration space.

Conveniently located by both the West Lobby and the Gradient Gallery, they will be ideal for meetings with internal and external partners, especially as part of larger events.



Research spaces

The Cryptography, Security and Privacy (CrySP) Lab

Securing data, protecting privacy in an increasingly connected world

CrySP carries out research in the areas of cryptography, security and privacy. We study a wide variety of topics, from designing cryptographic protocols to the evaluation of their effectiveness and usability in deployed systems.





"Privacy is a much broader concept than just keeping information secret. Privacy is about freedom, dignity and autonomy, some of the core ideals of democratic societies."

IAN GOLDBERG
Professor, David R. Cheriton School of Computer Science

The Systems and Networking (SyN) Lab



Building the secure, reliable and efficient infrastructure needed for the future of computing

The SyN Group designs, implements, analyzes and evaluates computer systems and networks that knit together disparate components to present cohesive, efficient and reliable operating environments. Our work spans everything from embedded systems to massive, globally networked infrastructures.

"The research that is going on in the SyN group focuses on improving the efficiency and reliability of computing and communication infrastructures. This has several pieces: there are mobile and data centre networks, there are several classes of distributed applications, there are operating systems, and much more. All of these pieces have to interact well together for an infrastructure to operate seamlessly as a whole."

MINA TAHMASBI ARASHLOO
Assistant Professor, David R. Cheriton School of Computer Science

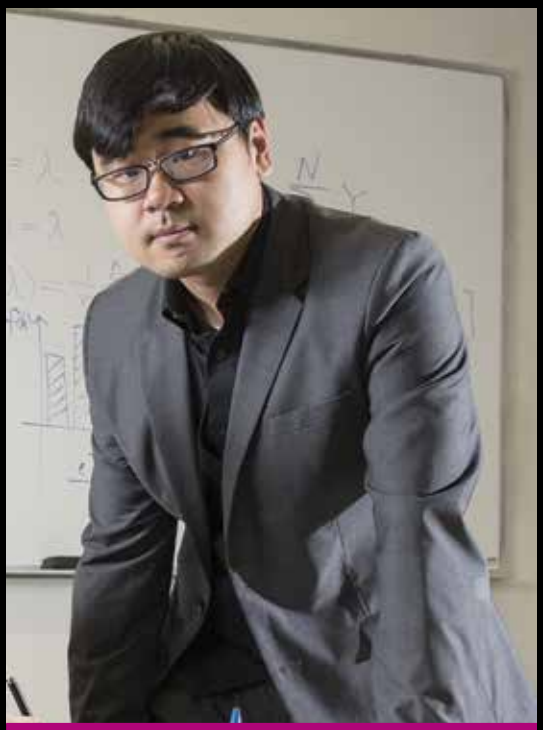


The Quantitative Risk Management Lab

Limiting financial risk in an uncertain world

The 2007 subprime mortgage crisis and the COVID-19 pandemic reveal how unexpected and highly uncertain events can expose weaknesses in existing risk frameworks. Quantitative risk management plays a vital role in helping individuals, financial institutions, and policy-makers understand, assess and manage such risks.

Led by Dr. Ruodu Wang, Professor of Actuarial Science and Quantitative Finance and Canada Research Chair in Quantitative Risk Management, the Quantitative Risk Management Lab aims to develop new methods for measuring and evaluating risk, supporting better portfolio management, process optimization and decision-making under deep uncertainty.



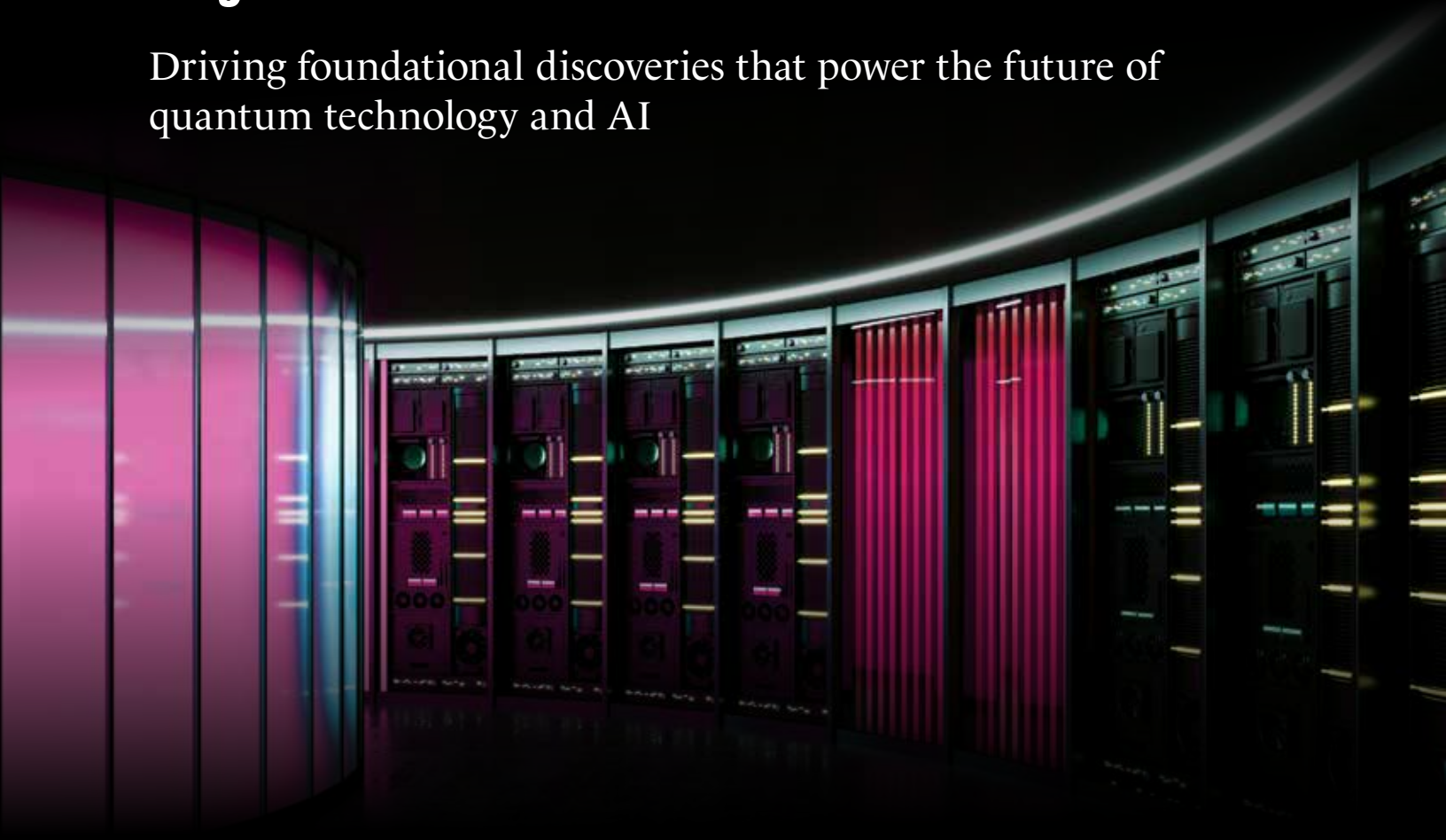
"The financial world is impacted by many unforeseen events, like the COVID pandemic, geopolitical tensions, climate change or trade wars. For these events, you don't have a lot of data to help you predict what will happen and what consequences will follow from your actions. I am developing new methods to analyze risk in scenarios where there is a high degree of uncertainty."

RUODU WANG
Professor, Department of Statistics and Actuarial Science



The Dieter Schwarz Chair in the Physics of Information and AI Lab

Driving foundational discoveries that power the future of quantum technology and AI



Dr. Achim Kempf, the Dieter Schwarz Chair in the Physics of Information and AI, pursues research at the frontier of quantum physics and AI. Kempf and his team explore how the physics of information – the deep principles governing quantum mechanics, information theory and computation – can unlock new paths for quantum-informed AI, quantum algorithms and next-generation computing systems. By bringing together these fields, the Chair aims to produce insights with transformative potential in areas such as cybersecurity, materials science and medicine.

"The physics of information is likely the key to understanding machine learning – and, vice versa, machine learning is likely to be the key to bringing quantum technology to maturity. That synergy holds the potential to dramatically change our way of life. It's a privilege to lead this research and build a global team of experts in the field."

ACHIM KEMPF
Professor, Department of Applied Mathematics





The Green Room

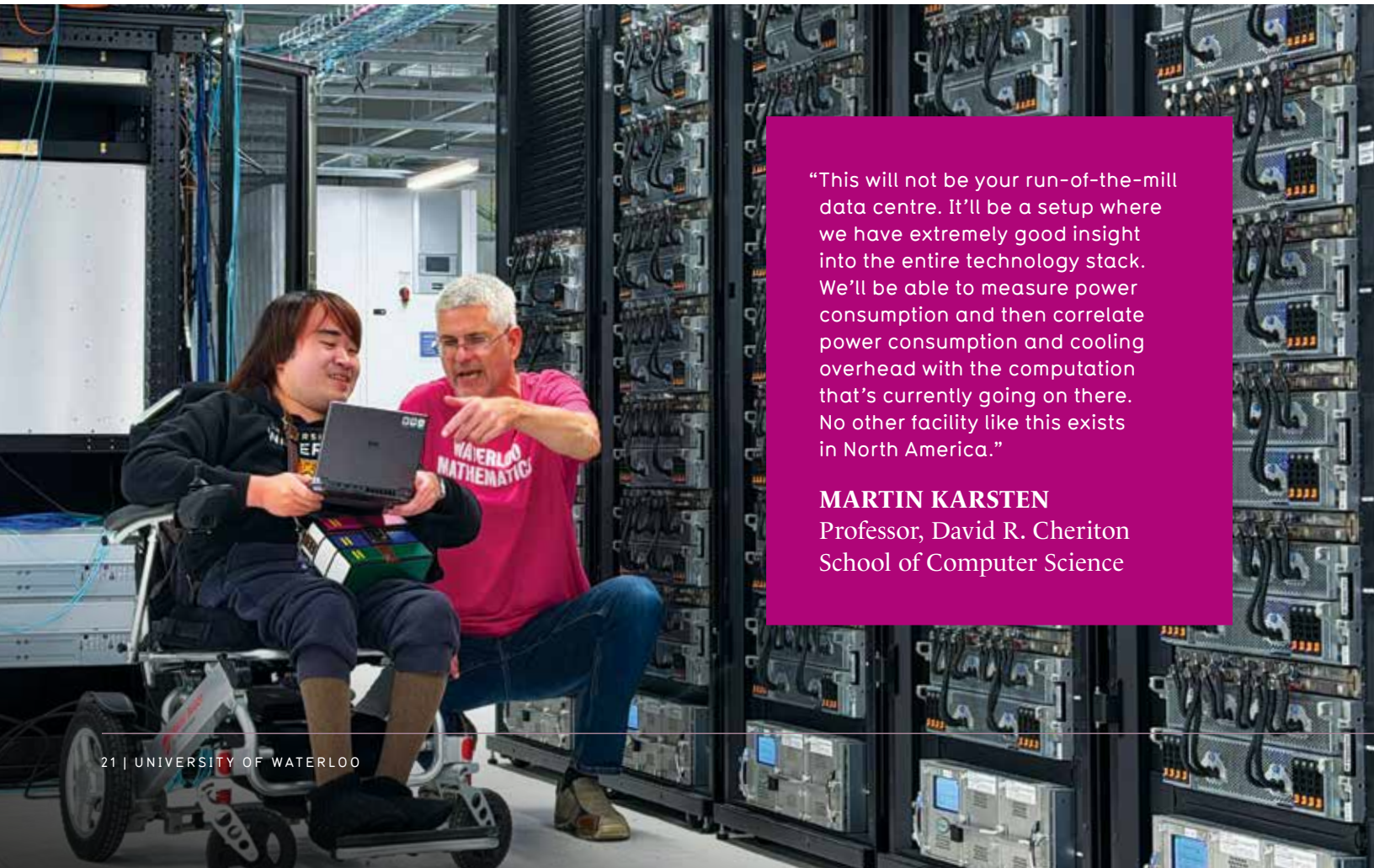
The future of sustainable computing

When we picture the drivers of climate change, it's often smokestacks, sprawling factories and transport trucks. But there's a less visible contributor we rarely consider – our daily digital activity.

Computing now consumes an enormous amount of energy. It is estimated to account for 5 percent of the world's total daily electricity. And that number is only expected to grow with the advent of artificial intelligence.

"We're burning up the planet, and it turns out that computing is part of the problem," says Dr. Martin Karsten, Professor and Associate Director of the David R. Cheriton School of Computer Science. "As computer scientists, we need to address that. We all have a part to play in building a greener future."

Enter the Green Room, a unique server room that will power computations across the Faculty while enabling researchers and students to study and improve resource efficiency.



"This will not be your run-of-the-mill data centre. It'll be a setup where we have extremely good insight into the entire technology stack. We'll be able to measure power consumption and then correlate power consumption and cooling overhead with the computation that's currently going on there. No other facility like this exists in North America."

MARTIN KARSTEN
Professor, David R. Cheriton School of Computer Science

What makes the Green Room unique?

The technology stack will be entirely reconfigurable, allowing researchers to experiment with different combinations of hardware and software.

Special sensors and monitoring tools will be integrated into the facility's infrastructure and computing equipment, enabling researchers to collect data on and analyze how resources are being used across the system.

The infrastructure will also integrate different cooling technologies and power supplies and will use innovative methods to capture and use residual heat.

The facility will be extensible, allowing new computing hardware to be added throughout its lifetime. It will remain relevant and cutting-edge.

What will the Green Room enable?

Studying resource efficiency across disciplines and applications
The Green Room will enable collaborative research into energy and resource use in a wide array of application areas – including AI, climate modelling, cancer diagnosis, graphics rendering and more.

Helping industry become more energy-efficient
By providing precise insights into how different hardware-software configurations consume energy, the Green Room can help commercial service providers to reduce the environmental impact and financial cost of their computing operations.

Teaching students to design and build sustainable computing systems
Students involved in Green Room research will gain expertise in energy-efficient computing. This positions the next generation of graduates to lead in a future where sustainability is a fundamental design priority.

Continuing the tradition
The Green Room's name is a nod to the storied Red Room in MC, home to the University's early IBM mainframes. Like the Red Room, the Green Room will enable major advances in education, research and entrepreneurship.

"We run climate models for important reasons, but we've never actually taken stock of how much these models contribute to the problem of climate change in the first place. The idea of resource-conscious computing is to make sure we're running these models in the best manner possible."

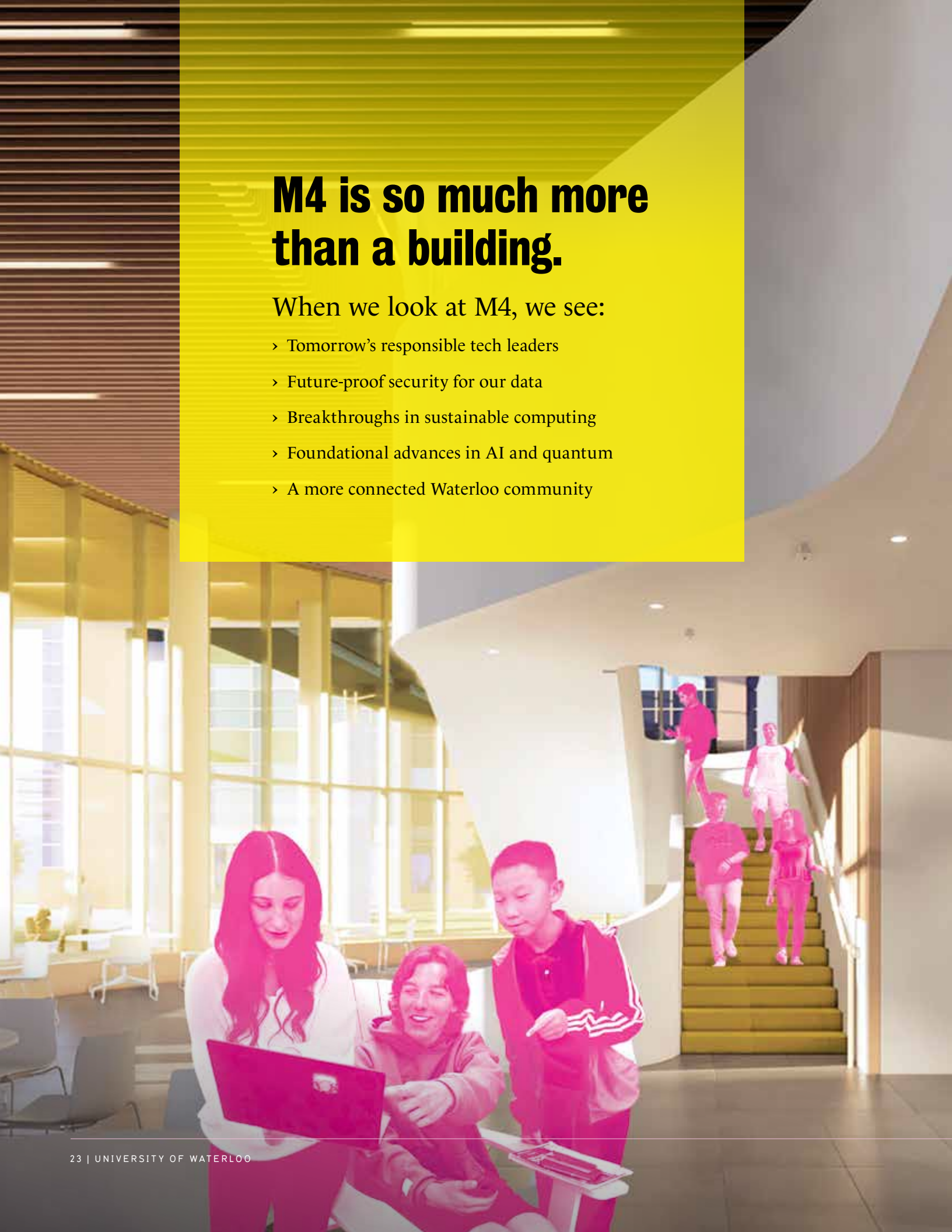
MAREK STASTNA
Professor, Department of Applied Mathematics



M4 is so much more than a building.

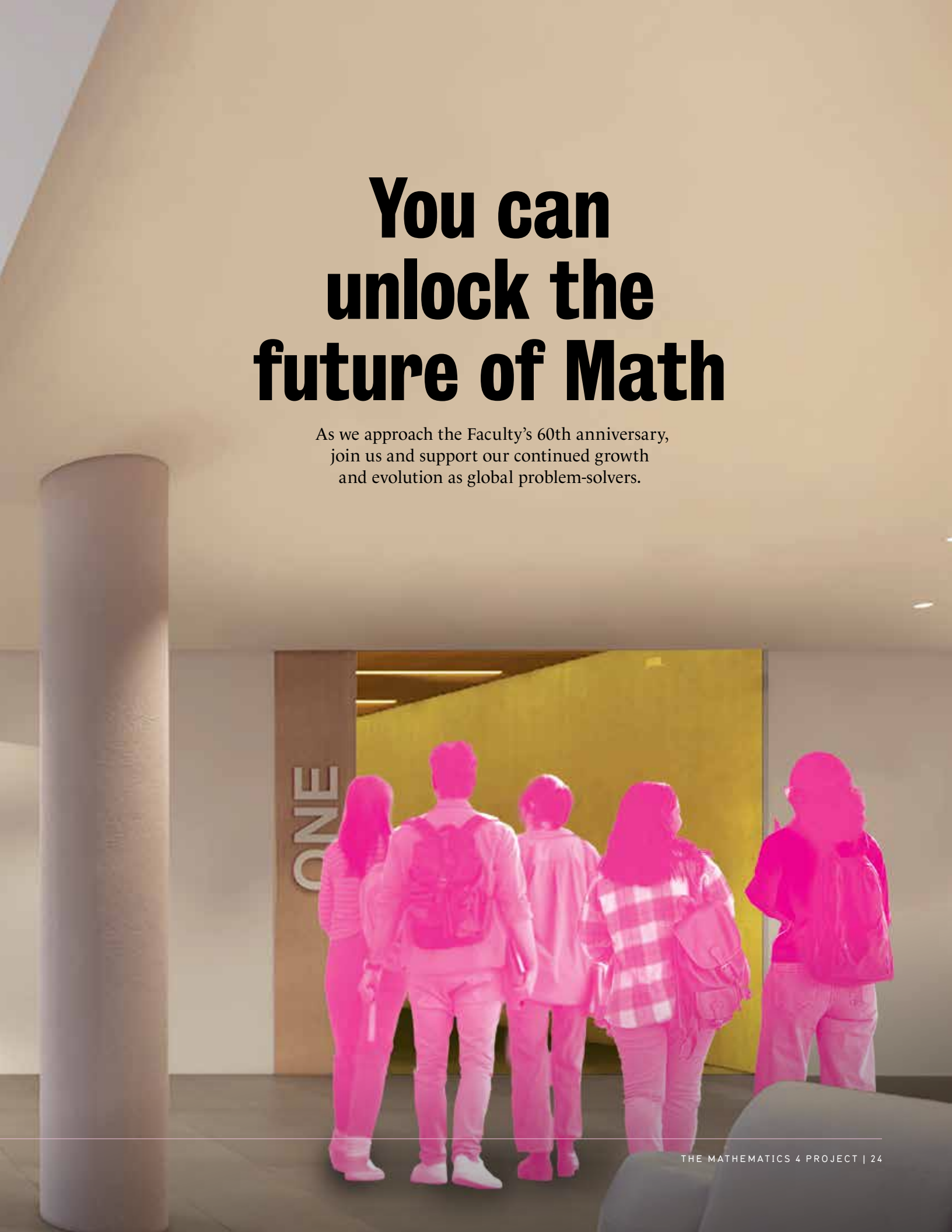
When we look at M4, we see:

- Tomorrow's responsible tech leaders
- Future-proof security for our data
- Breakthroughs in sustainable computing
- Foundational advances in AI and quantum
- A more connected Waterloo community



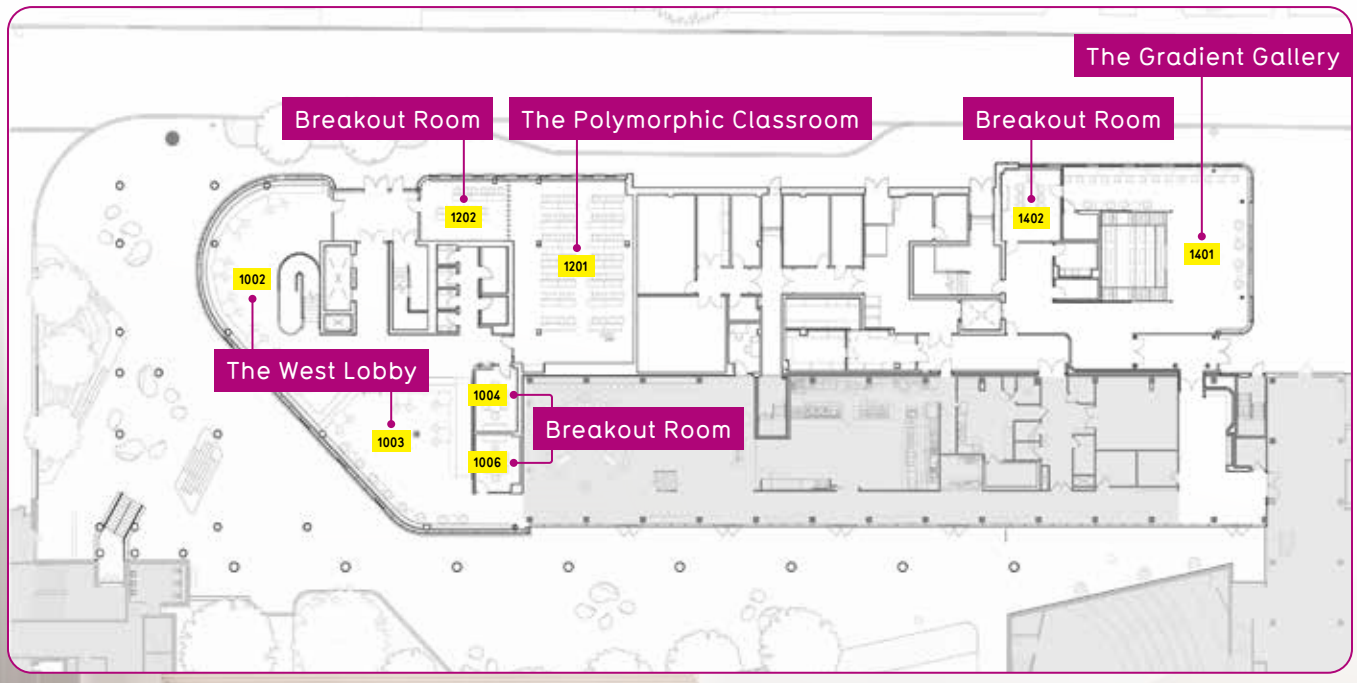
You can unlock the future of Math

As we approach the Faculty's 60th anniversary, join us and support our continued growth and evolution as global problem-solvers.



The floor plans

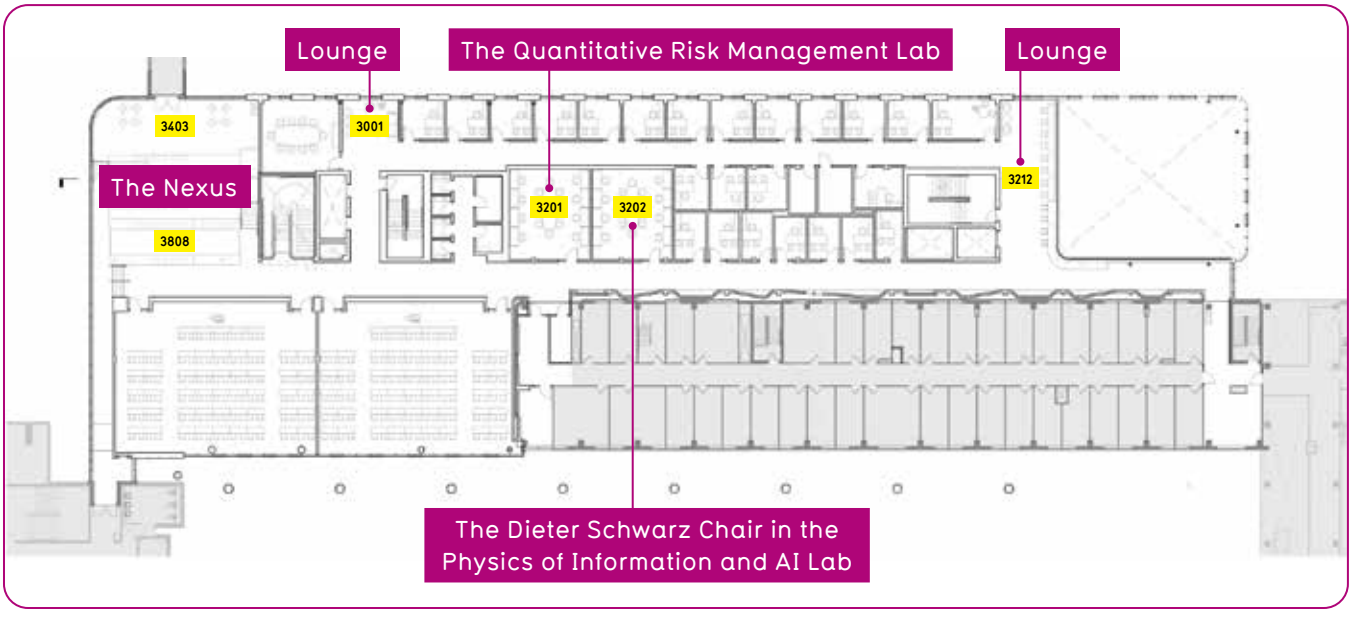
Floor 1



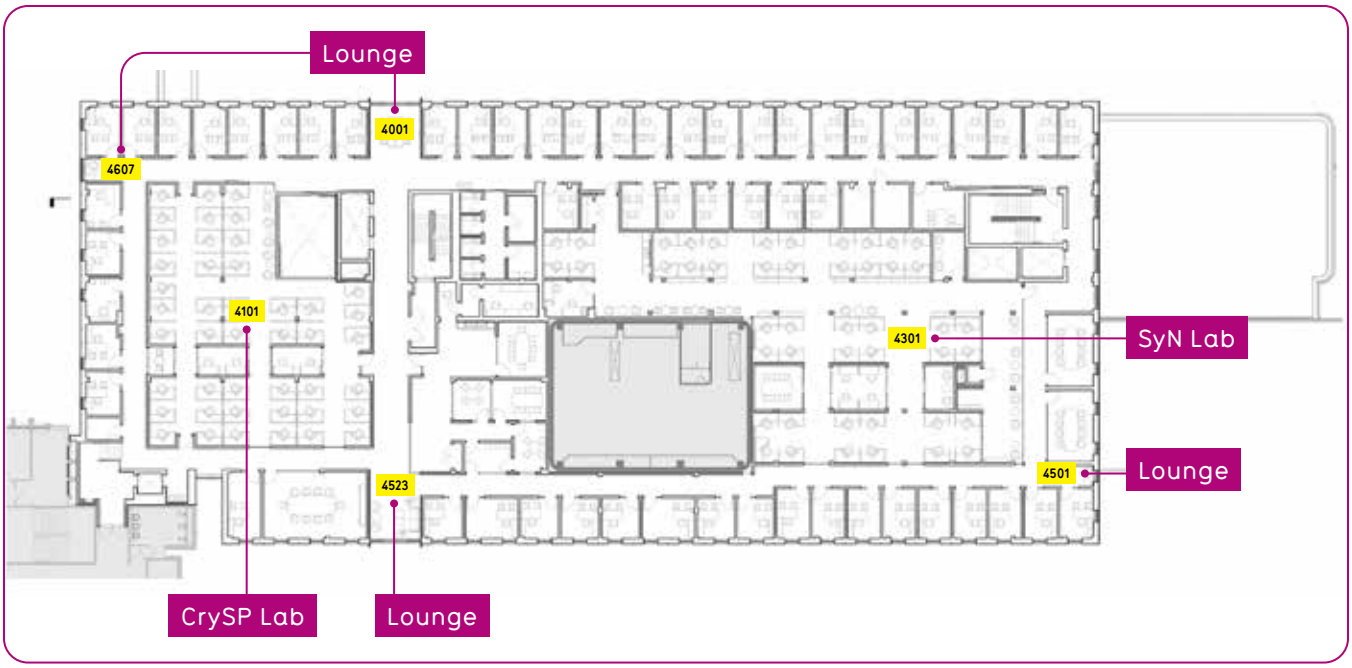
Floor 2



Floor 3

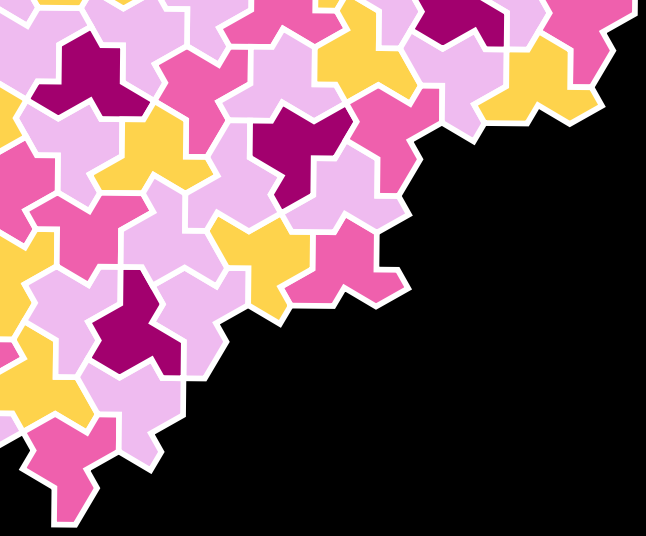

Lounge
The Quantitative Risk Management Lab
Lounge
3403
3001
The Nexus
3201
3202
3212
3808
The Dieter Schwarz Chair in the Physics of Information and AI Lab

Floor 4



Floor 5





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