

# The University of Waterloo's Physics Research Institutes

Hello and welcome back to the [Redacted Property Group Name] website and blog! It's no great secret that the Kitcher-Waterloo area boasts many of Canada's most well-regarded universities, but did you know it's also home to two of the world's foremost physics research institutes? In today's instalment of our series on the post-secondary institutions of the Waterloo Region, we'll be covering everything you need to know about the Institute for Quantum Computing and the Perimeter Institute.

In the Kitcher-Waterloo area, a large part of the local economy revolves around the higher education institutions it houses. Did you know that over the last decade, the University of Waterloo had an economic impact that can be counted in billions<sup>1</sup> according to one Deloitte Canada study<sup>2</sup>? If you've ever considered working in Waterloo's thriving quantum tech sector or wondered what your academically-minded neighbours get up to in their equation-filled, blackboard-clad offices, now may be the time to dive right in.

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<sup>1</sup> "University Of Waterloo's Economic Impact In The Billions: Study". *Citynews Kitchener*, 2019, <https://kitchener.citynews.ca/local-news/university-of-waterloos-economic-impact-in-the-billions-study-1874553>. Accessed 14 Apr 2022.

<sup>2</sup> *Uwaterloo.Ca*, 2022, [https://uwaterloo.ca/about/sites/default/files/uploads/documents/university\\_of\\_waterloo\\_economic\\_contribution\\_analysis\\_2019.pdf](https://uwaterloo.ca/about/sites/default/files/uploads/documents/university_of_waterloo_economic_contribution_analysis_2019.pdf). Accessed 14 Apr 2022.

# The Institute for Quantum Computing (IQC)

The Institute for Quantum Computing, largely, does exactly what it says on the tin. Still confused? Not to worry. In addition to world-class research, the IQC has a thriving and robust [public outreach program](#) and enthusiastically shares its work with the larger community. From online resources to classroom visits, the outreach team is champing at the bit to tell you all about q-bits and why they're the future of physics and computing. Fortunately, all you have to know for now is that quantum mechanics is the study of the physical properties and behaviours of extremely tiny (or subatomic) particles and that they have all kinds of weird, wacky and potentially game-changing properties.

## History

While it turns only twenty years old this year, the IQC has already made its mark on the world stage. Not only can it boast over 2000 publications to date and more than 2300 fully trained researchers produced<sup>3</sup>, but IQC researchers have launched 15 startups in the 20 years since its inception.

A large portion of the initial funding for the establishment of the IQC was provided by the creator of the BlackBerry, Mike Lazaridis<sup>4</sup>. His belief in the IQC's vision of interdisciplinary research paired with intellectual freedom has truly paid off and positioned Canada as a global

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<sup>3</sup> "About | Institute For Quantum Computing". *Institute For Quantum Computing*, 2013, <https://uwaterloo.ca/institute-for-quantum-computing/about>. Accessed 14 Apr 2022.

<sup>4</sup> Ibid.

leader in quantum scientific and technological development. This rise has largely been spearheaded by the IQC. Fun fact: some have even nicknamed the Waterloo area the “quantum valley” as a callback to California’s silicon valley as a testament to how quickly and explosively the industry has developed.

## Research

The IQC focuses on four core research pillars, all of which they address in an interdisciplinary way and on a spectrum from theory to experiment. In short, this means that rather than splitting up their work according to how a particular researcher conducts their research or in which field they were trained, they split it up according to its larger implications in the field.

The four cores are:

1. Quantum computing, or how do you get quantum-based computers that work and how do you make them better than regular computers?
2. Quantum sensing, or how do you use quantum mechanics to make better, smaller and/or more efficient sensors?
3. Quantum communication, or how do you use quantum mechanics to communicate more securely than we can currently communicate without quantum mechanics?
4. Quantum materials, or do you make interesting and better materials by using quantum mechanics?

In addition to their academic research conducted at the IQC, 30%<sup>5</sup> of research leads at the institute are involved in commercialization, meaning that they are directly involved in making sure that their academic work is concretely applied to the real world.

## The Perimeter Institute

The Perimeter Institute is dedicated to the study of theoretical physics and focuses largely on research and training. With rigorous, world-class programs ranging from their PSI START Program -- designed for recent graduates who wish to apply to post-graduate programmes in physics -- through PhD programs and beyond, the Perimeter Institute is one of the foremost places in the world to train as a theoretical physicist.

Not to be outdone by its sister institution, the Perimeter Institute also has an outreach program. It focuses largely on students at the elementary through the undergraduate level but has some programming for the larger community as well. They've released a series of stylized posters celebrating extraordinary women in science, which you can [download for free on their website](#).

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<sup>5</sup> Ibid.

## History

The Perimeter Institute was founded in 2000 and has been solidifying its position as a giant on the world stage ever since. The list of awards received by Perimeter Institute researchers is intimidatingly long and includes among other things two Nobel Prizes, two researchers named as Officers of the Order of Canada, a Fellow of the Royal Society and three Breakthrough Prizes in Fundamental Physics<sup>6</sup> -- and all that and more just since 2015!

Among its esteemed faculty, the Perimeter Institute was fortunate enough to have Stephen Hawking as its first Distinguished Visiting Research Chair in 2008. This launched a period of accelerated growth for the institute in the following years, which brought with it the pioneering of some of its larger outreach and educational programs. Recent growth and innovation initiatives have focused on their inclusion, diversity, equity and accessibility (IDEA) project.

## Research

At the Perimeter Institute, no area of theoretical physics is off-limits. From cosmology (the study of the universe, how it started, how it's evolving and how it might end) to particle physics (the study of the tiniest building blocks of the universe around us) if you can imagine it, someone at the Perimeter Institute has probably made it their life's work.

The question that unifies the institute's research is "how does the universe work?" and the researchers are free to pursue answers through both standard and sometimes creative and

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<sup>6</sup> "Honours And Awards | Perimeter Institute". *Perimeterinstitute.ca*, 2022, <https://perimeterinstitute.ca/honours-and-awards>. Accessed 14 Apr 2022.

unorthodox paths. As it's an institute for theoretical physics, most of the work is done with old-fashioned chalk and blackboards, but it's not uncommon for researchers to collaborate with more application-minded experimentalists in other parts of the university.

## Conclusion

The Institute for Quantum Computing and the Perimeter Institute are unique and world-class institutes nested in our very own Kitchener-Waterloo community. Be it through the groundbreaking research being conducted within their walls, the booming quantum-based technology sector they've created, the public outreach and education they engage in or the local economy their full-time and visiting researchers bolster, the University of Waterloo's institutes contribute to a healthy and lively local community.